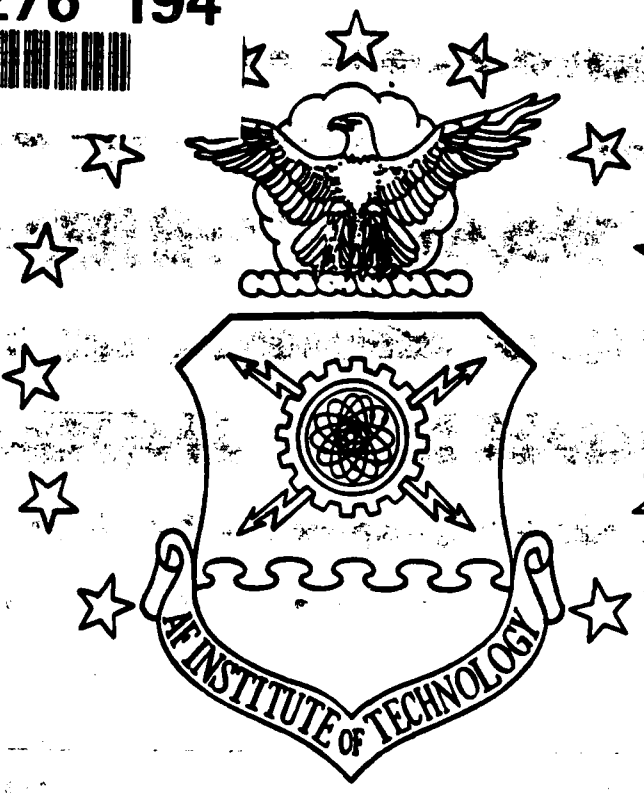

LOCAL AREA NETWORK IMPLEMENTATION AT THE 4950TH TEST WING: A STUDY OF THE RELATIONSHIP BETWEEN INDIVIDUAL FACTORS AND THE EFFECTIVENESS OF A LOCAL AREA NETWORK

THESIS

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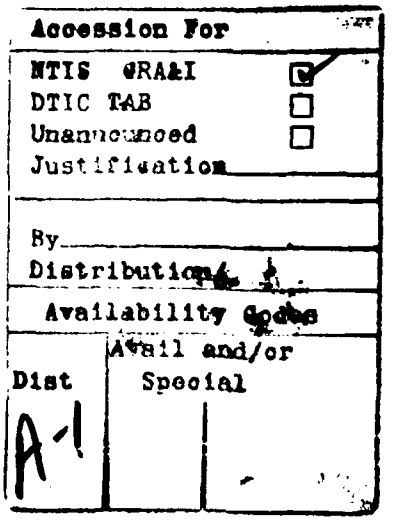

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THESIS

Presented to the Faculty of the Graduate School of
Logistics and Acquisition Management
of the Air Force Institute of Technology
Air Education and Training Command
In partial Fulfillment for the Degree of
Master of Science in Information Resource Management

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Preface

The purpose of this study was to investigate the relationships between individual factors and the effectiveness of the 4950th Test Wing local area network. Further, based on the results of this analysis, the study was intended to provide recommendations which would optimize the effectiveness of the local area network.

A study of this nature is important to the Air Force which has recognized the importance of employing information systems to facilitate management decision-making. It is therefore imperative that information systems, including local area networks, be effectively implemented and managed.

We would like to acknowledge the help of our thesis committee, Dr. Kim Campbell and Captain Marsha Kwolek. Special thanks go to the 4950th Test Wing network managers, Mr. James Harris, 4950 TW/SC, MSgt Dale Shires, 4950th TW/MA, Mr. Carlos Lizardi, 4950th TW/FF, and Ms. Barbara Moran, 4950th TW/AM. Their extra efforts were instrumental throughout the entire thesis process, from initial conception and approval, to final completion. Major Cone would like, above all, to thank his wife, Nancy, and two children, Christina and Brandon, for their unwavering love and support. Captain Donahoo would like to thank his wife, Buffy. Without her support, concern, and devotion this would have been an impossible task. In addition, Captain Donahoo would like to thank his son, Brandon, who was forced to do without a father for most of the last year.

Doyle F. Cone and David J. Donahoo

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Abstract

This research investigated the individual factors which directly impacted the effectiveness of the 4950th Test Wing local area network (LAN). Areas of interest included the relationships between demographic and user attitude factors and LAN effectiveness. A literature review provided the basis for: 1) operationally defining effectiveness as a subjective measure of user satisfaction; 2) identifying specific factors which impact information system effectiveness; and 3) developing a research instrument to measure user attitudes and user satisfaction. A questionnaire was administered to 342 LAN users; 173 were returned (a response rate of 51 percent). Fifteen factors (eight demographic factors and seven attitude factors) were treated as independent variables and user satisfaction was the dependent variable. Data analyses revealed that no demographic variables were significantly related to user satisfaction/LAN effectiveness. The global attitude factor (all seven attitude factors together) showed a positive relationship with the dependent variable. The two individual attitude factors, system understanding and training and job performance were the strongest predictors of user satisfaction/LAN effectiveness.

LOCAL AREA NETWORK IMPLEMENTATION AT THE 4950TH TEST WING: A STUDY OF THE RELATIONSHIP BETWEEN INDIVIDUAL FACTORS AND THE EFFECTIVENESS OF A LOCAL AREA NETWORK

I. Introduction

General Issue

Patrick J. McGovern, founder and CEO of International Data Group, the world's largest supplier of information services in information technology (IT), notes the importance of IT: "Information technology has dramatically reshaped the business landscape over the past 20 years in the US and globally and is essential to corporate growth and profitability" (1992:3). The explosion in IT was ignited by the introduction of the IBM personal computer (PC) on 12 August 1981 (Coale and Flynn, 1991:46).

Since that event, the world has witnessed astounding growth in the IT industry. In the early 1980s, 25 percent of the business population used computers. By 1986, there were 28 million computer workstations in the USA (Coale and Flynn, 1991:46). In the 1990s, close to 75 percent of working Americans used computers. In 1991, despite the soft economy, American companies spent $35 million on personal computing equipment, software, and services (Coale and Flynn, 1991:46).

The introduction of the PC-based local area network (LAN) marked the birth of the largest growth segment of the IT industry for the 1980s and 1990s (Stamper, 1991:12). This LAN boom resulted from lower hardware cost, availability of network and application software, and the integration of PCs into the workplace (Stamper, 1991:12). By the end of 1993, it is projected that 30 million computer users will be linked to a computer network and that 100 million will be linked by the year 2000 (Muller, 1992:8).

The United States federal government has openly embraced LAN technology. A recent study by the Business Research Group indicated that 55 percent of desktop computers in federal government offices are connected to LANs (Zurier, 1992:22). The reported desktop computer connectivity in other major industries are: 52 percent in manufacturing; 49 percent in banking and finance; 45 percent in retail industry; 43 percent in transportation; and 31 percent in health care field (Zurier, 1992:22). By comparing these figures, it is easy to see that the federal government is currently the largest LAN user in the nation. With this in mind, assessing the effectiveness of any information system (a LAN in the case of this study), once it has been implemented, has become an important area of interest.

The ideal measure of effectiveness of any system implementation would be based on cost effectiveness and productivity benefits (Ives and others, 1983:785). Unfortunately, information systems do not lend themselves to such quantitative analysis. In their article "The Measurement of User Information Satisfaction," Ives, Olson, and Baroudi, underscore the problems with applying quantitative methods to measuring the effectiveness of information systems:

> Theoretically, the determination of information system value is a matter of economics: the cost of system operations and development are subtracted from the actual benefits (in improved organizational effectiveness) to obtain the net value of the system to the organization. In practice, however, this may not be a simple determination because 1) intangible cost and especially benefits of information systems are difficult to recognize and to convert to their monetary equivalent;... ...3) data on system success may be determinable but not recorded by the organization and, therefore, unavailable for research purposes. (1983:787)

Many researchers have agreed that user satisfaction, a subjective and qualitative measure of system success, serves as a substitute for an objective measure of system effectiveness (Cyert and March, 1963:15; Ives and others, 1983:785; Cheney and Dickson, 1982:170). While this assumption may be true, it is also true that many

organizational and individual factors affect user satisfaction (Igbaria and Nachman, 1990:74).

With civilian and government organizations investing billions of dollars into LAN systems, it is vital for system managers to understand the relationship between individual factors, user satisfaction, and LAN effectiveness.

Theoretical and empirical literature on the subject of how user attitudes, demographic factors and effectiveness of an information system relate is prevalent, yet indicates a need for further study.

Justification

LANs have been implemented extensively throughout the Department Of Defense (DOD). Expenditures for this technology, while difficult to valuate, account for a considerable share of the DOD's $15 billion annual outlay for computing and communications. In 1992, in response to upwardly spiraling IT costs, the DOD released Defense Management Report Decision (DMRD) 918. This document required officials to review and evaluate all computing and communications expenditures.

DMRD 918 is the DOD's effort to gain some degree of control of the department's computer resources. The plan calls for providing hardware and software solutions to system users through centralized technical control and

configuration management. This provides a single unit to manage all computer assets. In addition, DMRD 918 provides system users with usage freedom through decentralized execution.

This initiative is designed to "ensure end-to-end information transfer capability which is protected, interoperable, and cost effective" (DMRD 918, 1992:1). System interconnections, through LANs and Wide Area Networks (WAN), will provide the backbone for successful DMRD 918 implementation.

With billions of dollars at stake, it is vital to ensure the effectiveness of every LAN system implemented within DOD. Each LAN is an important link in this new paradigm outlined in DMRD 918. Thus, it is imperative that research be conducted to assess LAN effectiveness and identify those individual factors which directly impact LAN effectiveness.

Problem Statement

The success of the LAN movement, as a whole, is fully dependent on the success of each individual LAN system implementation at the organizational level. It is, therefore, critically important to evaluate LAN implementations and identify the positive and the negative factors which directly impact the effectiveness of the LAN.

Research Objective

The objective of this study is to determine how effective the 4950th Test Wing LAN is and what relationships, if any, exist between user attitudes and system effectiveness and demographics and system effectiveness.

Research Questions

In order to achieve the research objectives addressed above, answers to the following questions must be sought:

1) Does previous research validate the use of user satisfaction as a measurement of system effectiveness?

2) Does previous research identify individual factors used to measure user satisfaction?

3) How effective is the 4950th Test Wing LAN as measured by the degree of user satisfaction?

4) What is the relationship between user attitudes, user satisfaction, and the effectiveness of the 4950th Test Wing LAN?

5) What is the relationship between demographic factors (i.e. age, gender, education, organizational level, and computer/LAN background), user satisfaction, and the effectiveness of the 4950th Test Wing LAN?

Scope and Limitations

This research examines the relationship between several individual factors and the perceived success of the 4950th Test Wing's LAN. The effectiveness of the 4950th Test Wing's LAN is operationally defined as a subjective measure of end user satisfaction. Previous research supports using the perceptions of users to evaluate system success (Cyert and March, 1963:15; Ives and others, 1983:785; Ginzberg, 1978:57; and Cheney and others, 1986:66).

The research study is limited only to those organizations within the wing that are connected to the LAN. The research focuses on approximately 345 authorized LAN users, all of whom were included in a census survey.

Thesis Organization

This introductory chapter briefly discussed the explosive growth of LAN technology and the importance of measuring system effectiveness. It further addressed user satisfaction as a valid measure of system effectiveness and reestablished the need to study and evaluate how user attitudes and demographic factors effect user satisfaction. Also discussed were the justification for research, problem statement, research objectives, research questions, and the scope and limitations of the research.

Chapter II, Literature Review, will provide a review of the pertinent literature concerning LAN implementation, user satisfaction as an effectiveness measurement tool, and the influence of individual factors on user satisfaction. Chapter III, Methodology, will explain the research methods and research design that will be used to answer the research questions. Chapter IV, Findings and Analysis, analyzes the results of the measurement tool. Finally, Chapter V, Conclusions and Recommendations, interprets and draws conclusions from the analysis and makes recommendations for further study.

II. Literature Review

Introduction

This review is divided into two major sections. The first section serves as an introduction to the concept of a Local Area Network (LAN). As well as developing the reader's knowledge of a LAN, this section describes the features and functions of the specific LAN under study (4950th Test Wing LAN). Although this section does not address any specific research objective, it is essential in developing a thorough understanding of operational definitions used in this study.

The second section addresses the first two research questions introduced in Chapter I. These questions are restated as follows:

Research Question 1

> Does the previous research validate the use of user satisfaction as a measurement of system effectiveness?

Research Question 2

> Does the previous research identify individual factors which can be used to measure user satisfaction?

User-Computer Relationship

In the early 1960s, only the elite few people interacted directly with computers. This was partially

because of the cost of the computers and partially because of the complexity of computer language (Shore, 1987:7).

The computer language during that time, was a pure mathematical code (Shore, 1987:7). Users who were knowledgeable of this programming language prepared their programs on IBM cards and brought stacks of cards (sometimes hundreds of cards) to the data processing centers where the cards were placed in a queue. These cards would sit in this queue for minutes or hours depending on the backlog of jobs (Shore, 1987:7). Other users, not fortunate enough to know any programming language, had to rely on the data processing center to compile their programs. The backlog for these requests was at best days long and could even last for months (Shore, 1987:7).

At this stage in the user-computer evolution, there were distinct lines between data processing activities and end-user needs (Shore, 1987:8). The data processing activities of this period were technologically driven, with even the simplest task requiring the user to learn complex commands. The prevailing attitude of the period was that it was the end users' responsibility to bridge this technology gap (Couger, 1986:87). In effect, the growth of end-user computing resulted from forcing technology on the users (Shore, 1987:9).

As the user's understanding of computers increased, so did the demands placed upon the data processing centers (Couger, 1986:87). This led to the introduction of the Local Area Network (LAN)--a technology which placed computing power on the desk of the end users. This event ushered in the era of end-user computing.

In the 1980s, end-user computing grew at a rate of 50 to 90 percent per year (measured by hardware allocations and time sharing expenditures). This becomes significant when compared to the remainder of data processing functions that grew at a rate of 5 to 15 percent during the same period (Couger, 1986:87).

This end-user computing is not a "flash in the pan" technology. Dickerson, Leithener, and Wetherbe questioned 54 experts using the Delphi method. These experts were questioned on the facilitation and management of end-user computing. This study revealed that end-user computing issues had grown in relative importance among experts. Ranked in an earlier study as the eleventh key issue, end-user computing rose to become the number one key issue for the information systems of the 1980s (1984:145).

The growth of end-user computing has been phenomenal. In a 1982 study of the Xerox corporation, researchers stated "It is particularly significant to observe the growth in

end-user computing" (Benjamin, 1982:14). This resulted from the fact that in the 1970s end-users were responsible for an insignificant amount of processor demand. In the 1980s end users consumed 40 percent of the processing cycles. The researchers predict that by the end of the 1990s that figure will rise to over 75 percent (Benjamin, 1982:14).

There is no foreseeable end to this growth. Researchers have predicted that in the 90s more than 50 percent of the computer resources will be in the hands of the end users (Lebleu and Sobowiak, 1986:18). As a result, much of the success of the data processing department (as well as the organization) depends on the ability to put this computing power in the hands of the end users and help them use it (Lebleu and Sobowiak, 1986:18). LAN technology is the answer to putting the computing power in the hands of the users. System effectiveness is a measure of how well system administrators are satisfying users needs.

Local Area Network

It is important at this point to determine the operational definition of a LAN. Various authors define LANs in various ways. For the purpose of this study, Martin and Chapman's definition is used:

> A datacomm system allowing a number of independent devices to communicate directly with each other, within a moderately sized geographic area over a physical communications channel of moderate data rates. (1989:4)

To promote further understanding of this definition, each segment is discussed below.

In this study, "independent devices" consist of shared devices (such as printers) and personal computers (PC) located on individual users' desks (Martin and Chapman, 1989:4). These devices communicate directly with one another via the datacomm system.

In the context of this study, "a moderately sized geographic area" (Martin and Chapman, 1989:4) refers to a datacomm system that spans a group of buildings within a 1 mile radius.

Finally, the communications take "place over a physical communications channel of moderate data rates" (Martin and Chapman, 1989:4). All the LANs in this study use an Ethernet cable system with speeds in the 1Mbps to 10Mbps range.

Perhaps even more important than a definition is the purpose of a network. In his book *Handbook of LAN Technology*, Paul J. Fortier explains the purpose as a primary goal and a primary reason for LANs. The goal of a LAN is make available, to those with a need to know, all the

information known to an organization (Fortier, 1989:37). The reason for a LAN is to provide resource sharing to all of the organization's data processing community (Fortier, 1989:56).

The first section of this review developed the concept of a LAN and the reason for its emergence as an industry standard. The remainder of the review develops the two concepts vital to this study: first is the concept of user satisfaction as a measure of system effectiveness, and second is a validation of individual factors which may affect user satisfaction.

Validation of User Satisfaction as a Measure of Information System Effectiveness

Advances in information technology, particularly the tremendous growth in the number and cost of information systems (IS) require that managers assess the quality and effectiveness of these systems as a means to justify their existence and continued proliferation. The issue of measuring the performance effectiveness of an IS has generated a great deal of debate and associated research over the last 30 years.

In the implementation of a LAN, as with any IS, the dependent variable of interest is "the degree to which the implementation effort was successful" (Ginzberg, 1979:86).

Defining system success and failure and understanding how and why systems succeed or fail have been a central focus of research and management attention.

System success or failure can be measured using many different dimensions and factors. As a result, the process of defining system success or failure is extremely arduous. According to Zmud, "evaluation of information systems success is a complex and perplexing issue" (1979:969). The multitude of system evaluation processes was streamlined by Green and Heim into three categories: performance, interface, and change (1983:11).

Performance evaluation applies to the stipulated goals of the system. Green and Heim operationally define performance as "the level of goal achievement" (1983:11). Interface evaluation entails examining the extent to which the system interacts with other resource components. A frequent measure of this process is the level of user satisfaction with system results. The evaluation of change involves appraising the change process at the individual, group, and organizational levels. The key element of this process is the requirement to continuously monitor, evaluate, and manage change to assure optimum system performance (Green and Heim, 1983:12).

The central focus of this research study is on measuring the effectiveness and success of the 4950th Test Wing LAN implementation. The principal factor in assessing the success or failure of the implementation of such an IS is whether it is effective in achieving its goals and objectives.

The establishment of operational and performance goals is essential to the implementation and evaluation of an information system. Ginzberg highlights the importance of system goals:

> Goals, the notion of what we are trying to accomplish, should be an integral part of the evaluation of any information system project. After all, a project can be truly successful only if it accomplishes what it was supposed to.(1978:61)

Birks also emphasizes the strategic importance of goals as the basis for any computerized IS. He iterates that "an information system should be designed to meet specific objectives" (Birks, 1971:45). Other researchers, including Degroff, have held similar opinions regarding evaluation of IS effectiveness. Degroff further accentuates the importance "to clearly identify the objectives the information systems are intended to meet" (1991:4).

Evaluating the success or failure of any system is a function of the validity and accuracy of the performance measurement process. The components of this process which

require meticulous development and validation are the construct and the instrument.

User Satisfaction Construct Validation. Several approaches to measuring system effectiveness which represent both objective or quantitative as well as subjective evaluation methods have been used in the research literature, including : 1) cost-benefit analysis; 2) levels of system usage; and 3) user satisfaction (Srinivisan, 1985:343).

Theoretically, assessment of system effectiveness and success is a function of the economic analyses of the information system's value (Ives and others, 1983:785). However, researchers have experienced extreme difficulty in empirically evaluating the economic cost-benefit outcomes of IS implementation (Raymond, 1987:187). Several have concluded that it is not possible to directly measure the impact of IS in terms of productivity benefits or other economic cost and benefits measures (Raymond, 1987:187; Ives and others, 1983:785).

Quantifiable measurement of IS effectiveness is impractical because of the nature of IS and their use within organizations (Ives and others, 1983:785). To a considerable degree, the costs and benefits of IS are intangible and cannot be precisely recorded in monetary

terms. In addition, it is difficult to assess the benefits accrued by systems performing multi-purpose roles in typically unstructured organizational environments. A third contributing factor to the problem of objective measurement of IS effectiveness is that most organizations do not record and maintain cost-benefit data even in those instances when it would be determinable. (Ives and others, 1983:786).

The quantifiable variable, system usage, has been frequently used as a surrogate measure of implementation success. In several studies in which the goal of the system is based on usage, the level of system usage has been a fairly effective indicator of performance. One problem identified with this approach is that "misuse" is a form of usage, and as such, undermines the value of usage as an indicator of system effectiveness (Raymond, 1987:174). Several researchers consider usage to be an insufficient measure of effectiveness, which if relied on solely, will result in biased and inaccurate measurements of system effectiveness (Ginzberg, 1978:59; Raymond, 1987:175).

Problems have also been encountered using system usage as an evaluation measure where usage is a goal of the system. In these cases, system users are mandated to use the system. Under these circumstances, both willful and reluctant users coexist, yet the usage measure fails to

distinguish between these distinct user groups and therefore biases the measurement results (Ginzberg, 1978:60). Pentland found in a study of IRS auditors, that even though the subjects had positive attitudes toward computer systems and used them extensively, use had little positive impact on performance, and possibly negative impacts. (Pentland, 1989:402).

Due to the inherent deficiencies in the quantitative measures of implementation success cited above, the one approach which has emerged as the most popular and frequently used substitute for economic or productivity measures is user satisfaction. User satisfaction has been widely accepted as a valid surrogate measure for IS effectiveness (O'Brien, 1977:4; Ives and others, 1983:785; Bailey and Pearson, 1983:530; Hamilton and Chervany, 1981:79; Raymond, 1987:173; Tan and Lo, 1990:203; Hiltz and Johnson, 1990:739).

As originally conceived by Cyert and March in their book *Behavioral Theory of the Firm*, user satisfaction as a measure of system success was the degree to which a formal IS fulfilled the manager's need for information (Cyert and March, 1963:124-125). Cyert and March postulated that the success of the IS in meeting those information needs either fortified or frustrated the user's level of satisfaction

with that system (Bailey and Pearson, 1983:530). Additional support for this premise is provided by Evans, who found that there exists a minimum user satisfaction threshold below which users will discontinue use of the IS (Bailey and Pearson, 1983:530).

Using the conceptual framework developed by Cyert and March, research conducted by Powers and Dickson and by Swanson established the foundation for acceptance and validation of user satisfaction as a surrogate of IS effectiveness. Power and Dickson's research was motivated and guided by their review of several IS articles which implied that user satisfaction was not increasing commensurate with systems expenditures (1973:148). Citing the growth in the number of systems as well as the strategic importance of IS to effective management decision-making, and the scarcity of empirical research, Powers and Dickson sought to determine what factors are correlates of IS success (1973:148).

In their study of 10 firms, of several potential factors analyzed, user satisfaction was found to be the most critical of those investigated. Powers and Dickson contend that while it is desirable for an effective IS to achieve time and cost economies, if a system does not satisfy the

user, it will be ineffective and ultimately fail (Powers and Dickson, 1973:153).

Swanson defined user satisfaction as a set of user beliefs about the relative value of an IS in terms of providing timely, accurate and easy-to-understand information to support management decision-making (Swanson, 1974:179). In this context, Swanson further validated the application of user satisfaction as a measure of system effectiveness in a study of a large international manufacturing company. Analysis of data collected from 37 users indicated a high correlation between user satisfaction and consistent use of the system (Swanson, 1974:186).

In 1983, Ives, Olson, and Baroudi operationally defined user satisfaction as the "extent to which users believe the information system available to them meets their information requirements" (1983:785). Since then, this definition, which closely resembles both the definition provided 20 years earlier by Cyert and March as well as that provided by Swanson, has been widely accepted as the standard throughout the IS research community.

In summary, there are two important points which emerged from the literature relevant to this research study. The first key point is the importance of focusing the evaluation of an information system on the goals of the

system itself. The measure used must be tailored to the specific goals and objectives of the system to be evaluated. Ginzberg states this key point:

> Once a goal for the project has been agreed on, an appropriate measure (or measures) of effectiveness, of project success or failure, can be defined... The key point is that the appropriate measure of effectiveness depends upon the intent of the project, its goals. (1978:61)

Secondly, the literature clearly indicates that there is a plethora of research frameworks for measuring the effectiveness of IS. While there is little consensus as to the one best framework, the measurement of user satisfaction as a surrogate for inadequate quantitative measurement constructs is one of the most frequently used measures and is characterized by consistently high validity coefficients in independent studies. Ives, Olson, and Baroudi state that among the reasons for its frequent use is that:

> satisfaction of users with their information systems is potentially measurable, and generally acceptable surrogate for utility in decision-making. (1987:788)

Thus, although user satisfaction is an imperfect yardstick for evaluating IS implementation success, it is the best available.

User Satisfaction Instrument Validation. Subsequent to the acceptance and validation of user satisfaction as an empirically legitimate IS measurement construct, research

efforts focused on developing a valid measurement instrument. Nolan and Seward developed a multi-item questionnaire using a five point scale to user satisfaction with computer generated output (1974:22). Debons and others developed a questionnaire composed of the following ten items to measure user satisfaction: accuracy, reliability, timeliness, assistance, adequacy, accommodation, communication, access, cost and environment. Users were asked to rate each item on a five point scale from very unsatisfactory to very satisfactory (Debons and others,1978:12). Neumann and Segev generated a similar questionnaire using four factors to measure user satisfaction with IS products: accuracy, content, frequency, and recency (1980:53).

Using this previous research base, Bailey and Pearson identify the need to develop a definition of satisfaction which "contains a complete and valid set of factors and an instrument which precisely measures these factors" (1983:531). Bailey and Pearson identified 39 factors relating to user satisfaction and concluded that a valid measurement instrument for user satisfaction could be developed (1983:538).

Using these 39 factors as the basis of their development effort, Bailey and Pearson constructed a 39 item

user satisfaction questionnaire (1983:539-543). They initially tested and validated their instrument using a sample of 32 middle managers in eight different organizations. Using conventional reliability and validity analyses, the results reflected significant correlations and represented a successful translation of their definition of user satisfaction into a valid operational instrument (Klenke, 1992:332). The Bailey and Pearson questionnaire is the most widely accepted and applied user satisfaction instrument in the IS research community (Tafti, 1992:4).

In an effort to replicate Pearson and Bailey's study and further reinforce the validity of the user satisfaction instrument, Ives, Baroudi, and Olson surveyed 200 production managers. The results of this study confirm the reliability and validity of the instrument but identify a need for further research of the instrument's psychometric properties using a more diverse cross-section of organizational environments (1986:14).

According to Bailey and Pearson, when using the instrument in specific applications, "it is reasonable to remove irrelevant factors and redefine the remaining instrument factors in situation specific terms" (1983:538). Several researchers have exercised this option in developing shortened versions of the original user satisfaction

instrument. For example, Baroudi and Orlikowski extended the work of Pearson and Bailey by developing a short version (13-item) of the user satisfaction scale (1988:44). Raymond reduced the Bailey and Pearson instrument to 20-items by eliminating factors irrelevant for the study of a small manufacturing organization (1987:173). Most recently, Tan and Lo selected 33 of the original 39 factors from the Bailey and Pearson instrument to study office automation (1990:204).

In a review of 35 studies by Goodhue, 13 of the studies use a variant of the Bailey and Pearson instrument (Goodhue, 1992:303). All of the modified instruments were analyzed and demonstrated to be highly reliable and valid measurement constructs.

Based on the literature review, it is clear that the Bailey and Pearson user satisfaction instrument (or a variant) is widely used throughout the information systems research community. In response to the early criticism of the instrument offered by Ives, Olson, and Baroudi, the instrument (or a derivative thereof), has been applied to an increasingly broad cross-section of populations with successful results. While a number of other instruments have been developed and are in use, few provide the consistently high degree of validity and versatility

provided by the Bailey and Pearson instrument (Tan and Lo, 1990:205).

Individual Factors Affecting User Satisfaction and Information System Effectiveness

The operational effectiveness of the 4950th Test Wing LAN is influenced by a broad range of individual factors. Managerial personnel within the wing dedicated to creating an effective and productive work environment should be aware of the effect of individual differences on work behaviors (Harrison and Rainer, 1992:95). Because of the integral role of IS in mission accomplishment, an understanding of these individual differences and their influence is critical to assessing the factors which determine the success or failure of these systems (Harrison and Rainer, 1992:96).

The success of IS is directly dependent on the information technology used and the degree of skill of the individual using the technology (Nelson, 1990:87). In effect, IS-oriented work behavior is controlled both by factors external to the user within the environment (e.g. job characteristics, job scope, responsibility, physical comfort, etc.) and internal characteristics of the user (e.g. age, education, experience, attitudes, etc. (Harrison and Rainer, 1992:94).

Zmud, who conducted one of the more comprehensive studies of the influence of individual factors on IS success, stated: "many factors are believed to impinge upon the success experienced by organizations regarding their development of IS"(1979:966). Academics and practitioners have investigated and addressed a broad scope of issues including: organizational characteristics, environmental characteristics, task characteristics, personal characteristics, interpersonal characteristics, information system staff characteristics, and information system policies (Zmud, 1979:966).

The focus of this section of the literature review will be limited to review and analysis of those factors of primary interest in the context of this research study, specifically: personal/demographic and attitudinal factors. Though existing research does not expressly address LAN implementation effectiveness, this review applies to the broad classification of IS which includes LANs.

Section one of this review will present several models which attempt to portray the relationships between organizational and individual factors and successful implementation. Section two will address existing research on demographic factors and how they relate to and impact both user attitudes and IS effectiveness. The third section

will introduce and evaluate previous research regarding the association between user attitudes and system effectiveness. Finally, conclusions based on this review and relevant to the current research study will be advanced.

A substantial number of researchers have identified the importance of analyzing the relationships between personal factors (e.g. age, sex, education, previous computer experience, organizational level, etc.) and IS success, and user attitudes and IS success. Several have developed models which illustrate the dynamic relationships between various factors and the effectiveness of IS.

Information System Models. Lucas, a pioneer in the empirical study of IS implementation, developed and validated a descriptive model of successful implementation of an IS. Figure 1 illustrates the model and illustrates the association between situational and personal factors and successful system implementation. The independent-dependent variable relationship depicted is based on earlier research (Lucas, 1975:81) which strongly supports this association.

Figure 1 also depicts a relationship between user attitudes and successful implementation. Previous research by Schultz and Slevin and Lucas originally established the correlation between this set of variables (1974:168-169; 1975:83).

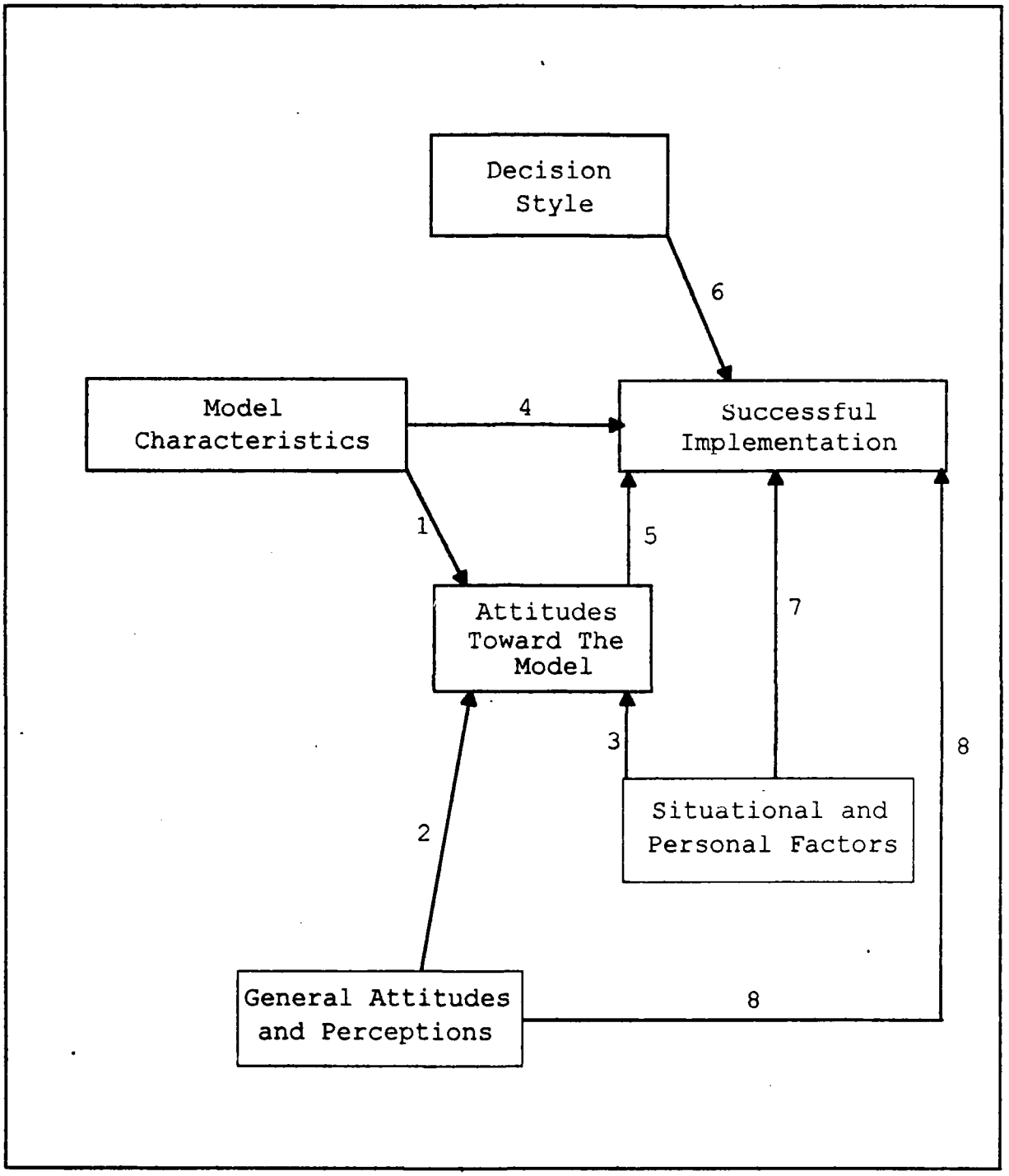

Figure 1. The Lucas Descriptive Model of Successful Implementation of a Computer-Based Model (reprinted from Lucas 1976:19)

The study by Lucas to validate this descriptive model involved measuring the success of an on-line computer-based planning model in a sample of firms. Table 1 displays the results of the study.

Based on the findings of this study, a strong relationship can be expected between user attitudes and successful implementation; a moderate relationship is likely to exist between situational and personal variables (e.g., user location, age, education, and previous computer experience) and user attitudes as well as between situational and personal variables and successful implementation.

TABLE I

EMPIRICAL RESULTS OF VALIDATION OF THE LUCAS DESCRIPTIVE MODEL OF SUCCESSFUL IMPLEMENTATION OF A COMPUTER-BASED MODEL (Reprinted from Lucas, 1976:19)

Relationship (as numbered on the model in Figure 1)	Strength of Relationship
1	moderate
2	moderate
3	moderate
4	strong
5	strong
6	weak
7	moderate
8	moderate

Zmud also constructed a descriptive model which focuses on the impact of individual differences on information system success. This model (Figure 2) has been referenced extensively by other researchers and is instructive for the current study based on its inclusion of both demographic and user attitude variables (1979:967). Zmud categorized individual-difference variables into three groups: demographics, personality, and cognitive style. In the model, system success is influenced by cognitive behavior and attitudes of the user. Demographic variables are personal characteristics such as age, gender, professional orientation, organizational level, education, and experience with computers (Zmud, 1979:967; Harrison and Rainer, 1992:95).

Robey developed and designed a model to address system implementation problems. Robey succinctly stated the basic problem: "information systems can and do fail where user psychological reactions and organizational factors are ignored by system designers" (Robey, 1979:527). The Robey "Model of User Behavior" (Figure 3) specifically addresses the relationship between user attitudes and user behavior. In his model, Robey adopts system usage as the measure for the dependent variable of the model--successful implementation. He clearly states, however, that system use

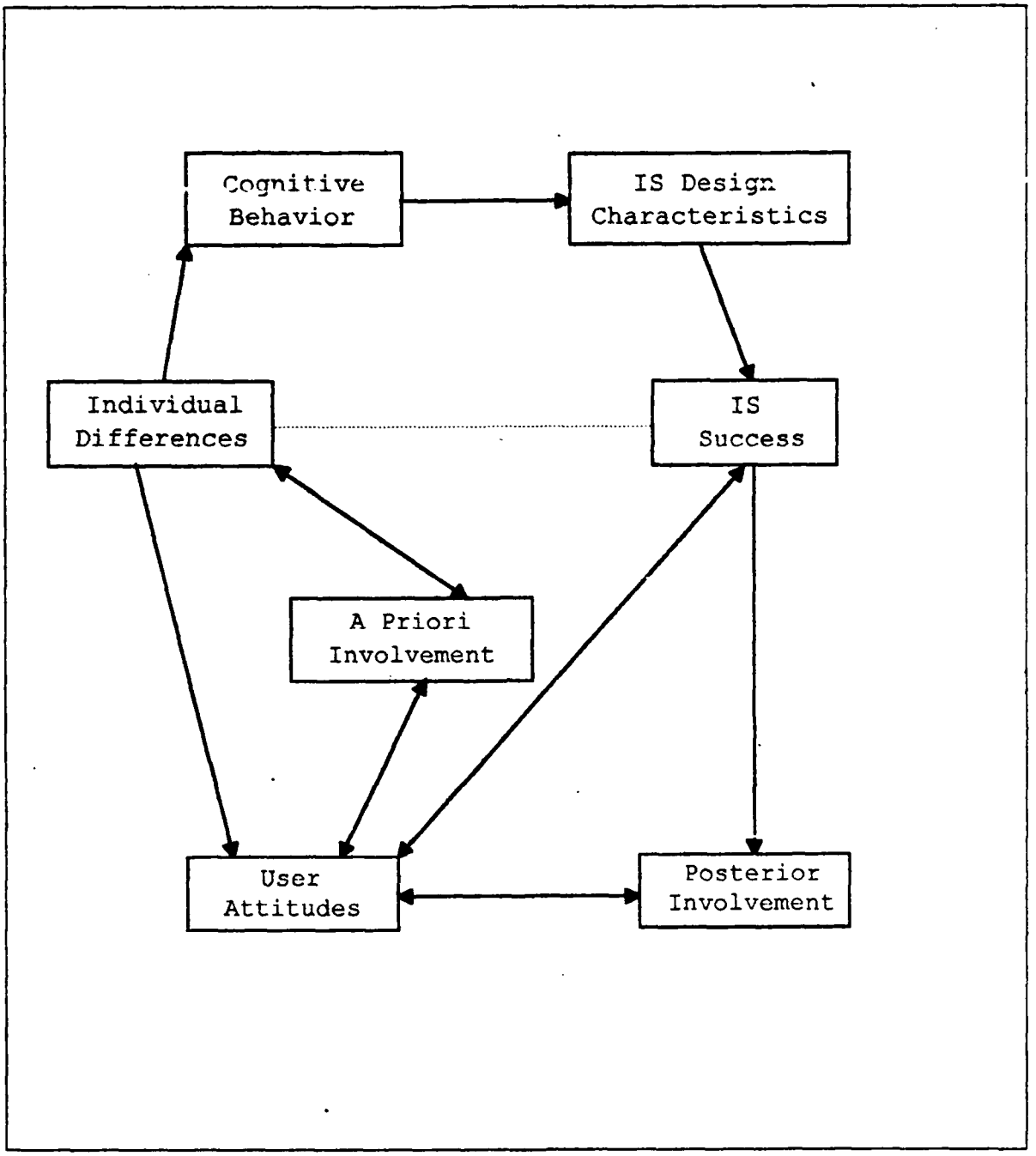

Figure 2. The Zmud Model of the Impact of Individual Differences Upon IS Success (reprinted from Zmud, 1979:967)

is not the only variable of interest. According to Robey, user satisfaction, especially in those situations where system use is not optional with the user, is a more meaningful criterion for system success (1979:534).

The Robey model is based on the expectancy theory of motivation. In brief, this theory maintains that an individual's behavior in a given situation is a result of continuous evaluation by that person of the consequences and outcomes of his/her actions (Robey, 1979:534).

Applied in terms of this theory, the Robey model demonstrates that before an individual uses the system, he/she evaluates various relationships. As a by-product of this process, the user develops attitudes concerning several potential consequences:

1. the value of rewards received from performance,
2. the probability of rewards resulting from performance,
3. the probability that performance results from use (1979:535).

The model clearly demonstrates that job performance is influenced by both user characteristics such as age, experience, and training as well as by system characteristics. The inference is that job performance may recede in spite of extensive use of the system if it provides inaccurate information to the users. If the

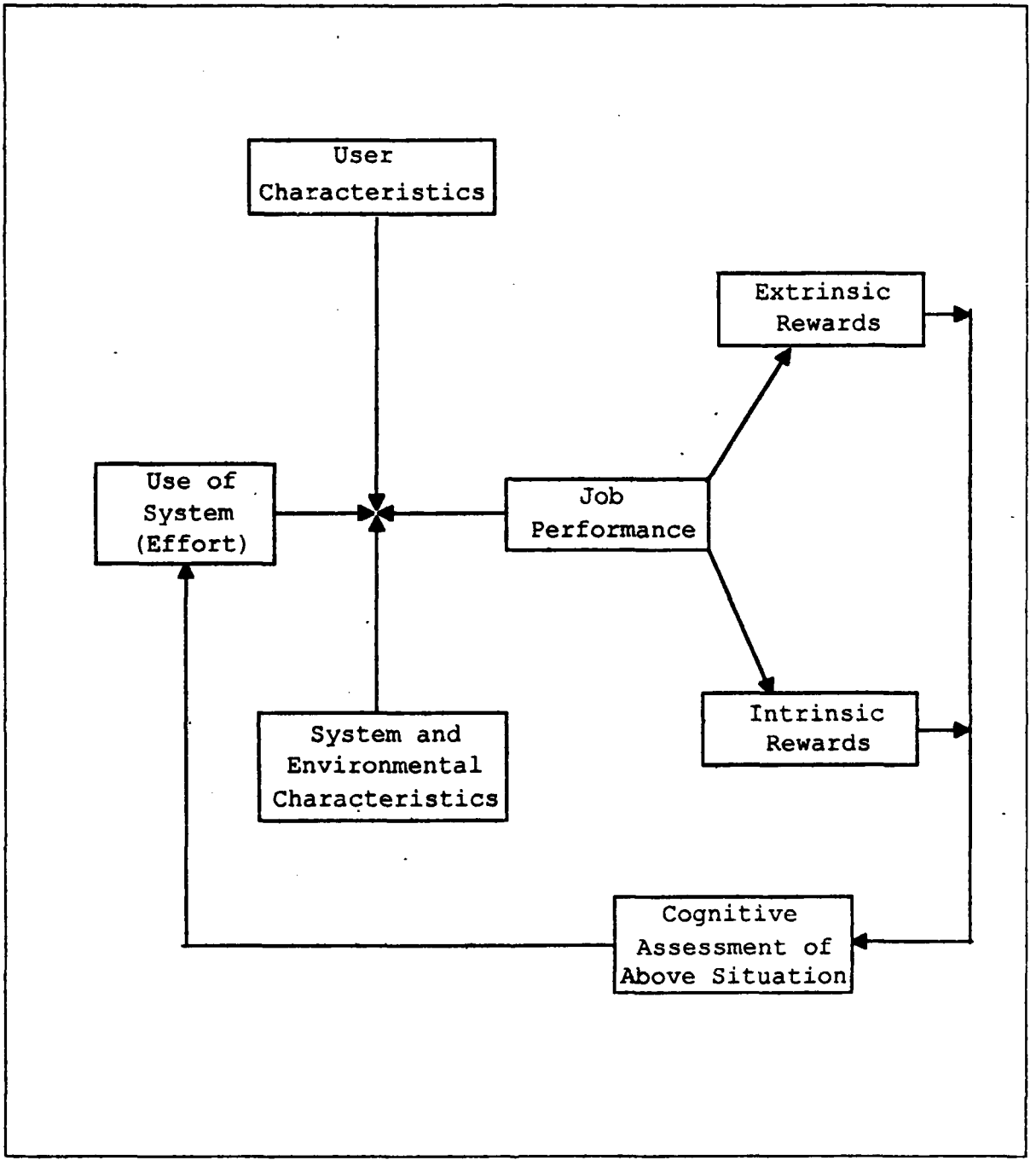

Figure 3. The Robey Model of User Behavior (reprinted from Robey 1979:535)

consequence of low performance is lower job rewards, users are apt to reduce their use of the system and find other means to increase performance and rewards. Furthermore, the model directly implies that use of the system will not increase even if performance depends heavily on use unless rewards are contingent on performance (Robey, 1979:535).

Tanlamai developed a factor model (Figure 4) designed as the framework for a study to identify and empirically test factors that influence the success or failure of a computer-based information system (1990:2). The inclusion of the personal factors of age, time on the job, and experience, as well as the perceived effectiveness of training, was based on previous justification of the importance of monitoring these variables by other researchers (Lucas, 1981:47; Fuerst and Cheney, 1982:555; Yaverbaum, 1988:75). The predisposition variables were included because they encompass both disposition (e.g., personal traits, attitudes toward technology) and situational (e.g., attitudes toward current job) effects on attitudes and behaviors (Tanlamai, 1990:3).

The preceding models illustrate a positive association between attitudes and information system effectiveness. Conversely, Schewe contends that no significant relationship exists between user attitudes and perceptions toward their

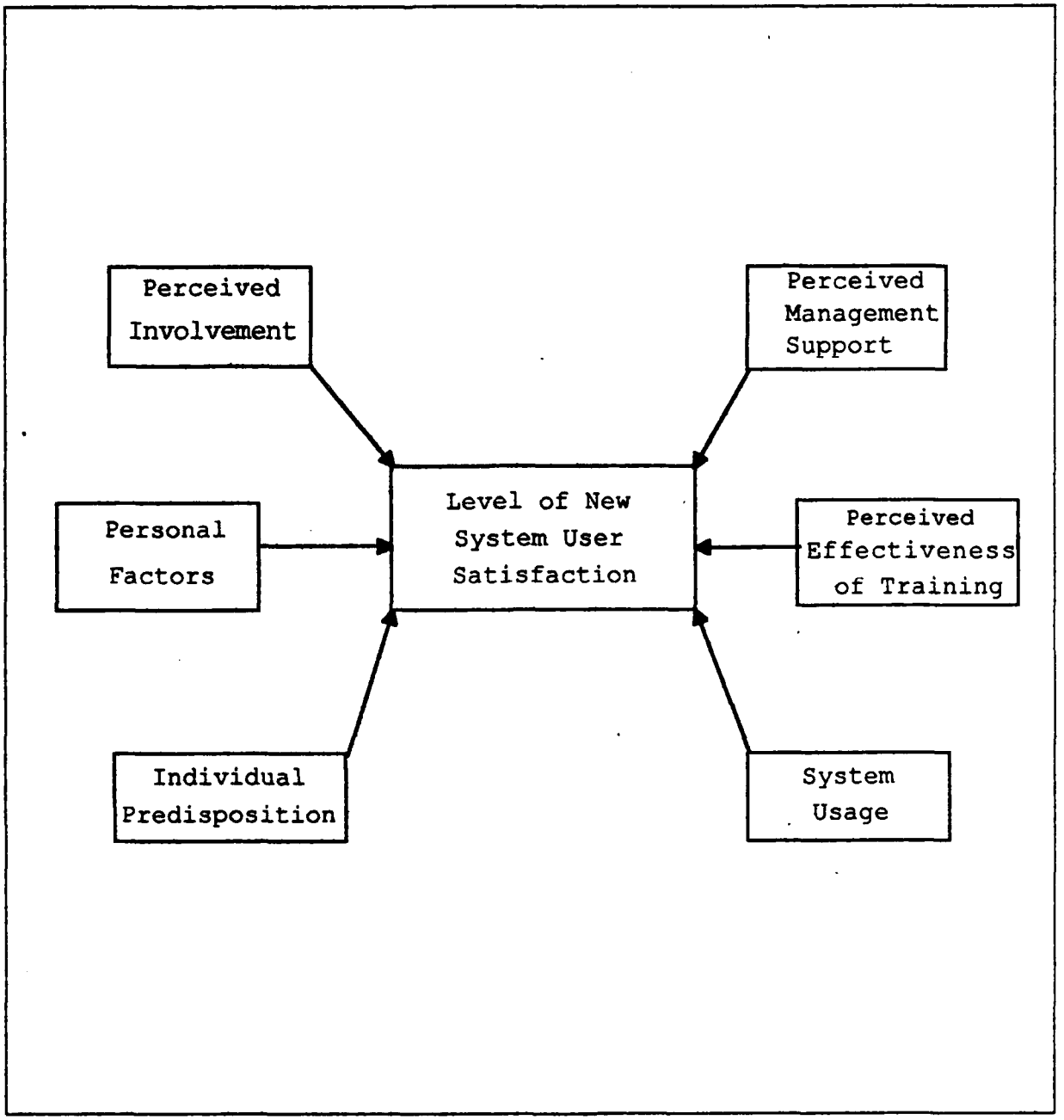

Figure 4. The Tanlamai Factor Model of the Influence of Factors on System Effectiveness (reprinted from Tanlamai, 1990:3)

information system, perceived variables external to the system, and system usage (adopted in lieu of user satisfaction as dependent measure of system effectiveness) (1976:580).

He illustrates this theoretical premise in the model in Figure 5. Schewe later demonstrated the validity of his conclusions empirically in a study of 77 marketing managers from ten food processing firms in three mid-western states. The results of this study corroborate his theory--no significant relationship exists between attitudes and system use by managers (1976:582-584).

The model shows that attitudes are established as a result of the user's evaluation of a set of beliefs in respect to an object. It also identifies constraints that influence the relationship between attitudes and usage. According to Schewe, these situational constraints intercede between attitudes and usage to such a degree that the relationship is counteracted. A practical example is a situation in which an individual may have a negative attitude toward the system yet uses it to please his/her superior.

While Schewe's findings and conclusions are contrary to those of other researchers in respect to attitudinal effects, they cannot be dismissed as theoretical and

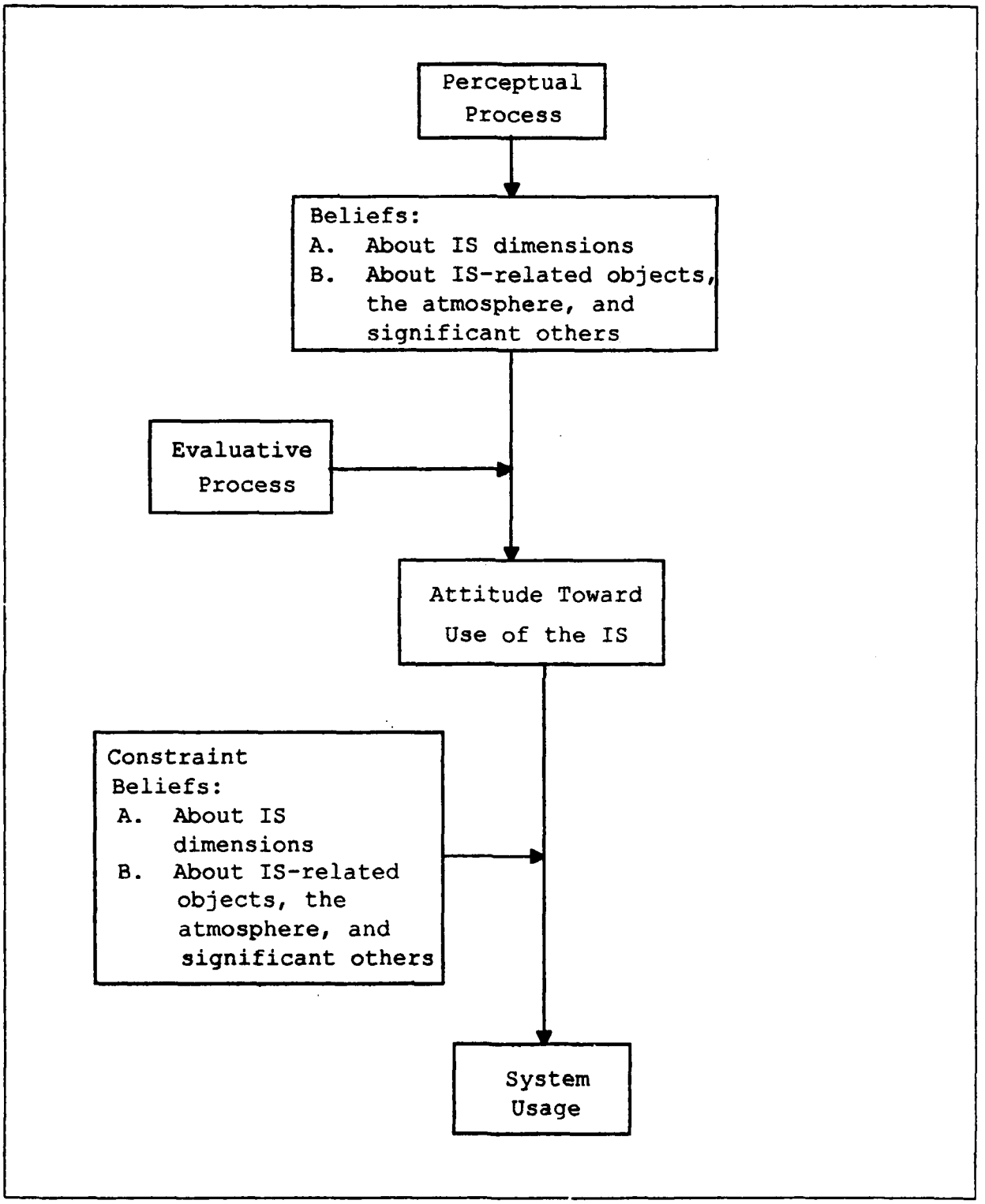

Figure 5. The Schewe Behavioral Model of System Usage (adapted from Schewe 1976:578)

empirical aberrations. However, because Schewe only addressed system usage and not user satisfaction as well, his conclusion regarding the relationship between attitudes and usage does not guarantee that a similar relationship exists between attitudes and user satisfaction.

As discussed earlier in this literature review, system usage is only a partial measure of system success and in some cases can be a poor criterion of success. Consequently, the conclusions derived from this, as well as other models with this limitation (Lucas and Robey), are constrained by the context of the variables defined in the models.

This portion of the literature review sought to identify and distinguish several theoretical models of information system implementation efficacy. While they differed in content and alignment, they all represented the influence of user attitudes and situational and personal variables (e.g., location, age, education and experience) on the operational effectiveness of an information system. Each model depicted the existence of a multitude of variables which interact dynamically with attitudes in influencing system effectiveness. Having reviewed the general framework advanced for empirical study of information system success, the next step is to review what

is known about the specific independent variables of interest in this study.

Personal/Demographic Factors. Several researchers have studied the relationships between demographic variables and user attitudes and demographic variables and user satisfaction. The personal factors most frequently used in these studies as independent variables are age, gender, education level , and computer experience.

Office lore often alludes to the resistance of older, longer-term employees to acceptance of the changes associated with the computer and information technology revolution. Numerous researchers have empirically substantiated the dissatisfaction of older employees with computers and information systems.

Raub reported that in general, older employees hold more unfavorable attitudes toward microcomputers and information systems than do younger employees (Harrison and Rainer, 1992:96). Lucas' findings in the study referenced earlier of the successful implementation of an on-line computer-based planning model support this conclusion. Lucas stated, "longer-term employees have less favorable attitudes toward the model" than shorter-term employees (1976:54). In a study of computer operators, Nickell and

Pinto also found age was negatively correlated with computer attitudes (1986:302).

Previous experience with computers and information systems is frequently associated with positive user attitudes and levels of system satisfaction. Individuals owning computers were found by Levin and Gordon to be more willing to familiarize themselves with computers and to possess more affective attitudes toward computers than did non-owners (1989:73). A study conducted in a manufacturing enterprise revealed that shop-floor employees who had previous experience with computers had more favorable attitudes toward the integration of advanced, computer-based manufacturing monitoring and control systems (Harrison and Rainer, 1992:96).

The effect of education on user attitudes and implementation success has received increased emphasis from both managers and researchers. This relationship is of critical importance to managers contemplating developing and implementing an information system. In response to this demand for empirical data, several researchers have found that level of education is positively correlated to better performance in a computer training environment, as well as to favorable computer attitudes (Harrison and Rainer, 1992:96). Lucas found that less-educated individuals

possess more negative attitudes toward information systems than individuals with more education (1978:37).

Only one research study could be found which explored the relationship between gender and user satisfaction with information systems. Dambrot and others suggested that women have a higher level of anxiety toward computers and are generally more dissatisfied with systems (Igbaria and Nachman, 1990:76).

User Attitudes. Factors in the success of information systems have been a topic of research since the early 1970s. The original motivation for this research was the recognition by practitioners and researchers of the high rate of failure in information system implementation so frankly characterized by Russell and Ackoff:

> Contrary to the impression produced by the growing literature, few computerized management information systems have been put into operation. Of those I've seen that have been implemented, most have not matched expectations and some have been outright failures. (Swanson, 1982:158)

Researchers have pinpointed many factors which cause information systems to fail and have identified several key areas to address in implementation to ensure the success of an information system. One area which has received a great deal of empirical attention is the effect of user attitudes on system effectiveness and success. According to a study by

Cerullo of 122 US corporations , of all the factors that may affect the success of an information system none are as important as "user attitudes" (1980:10).

The general significance of attitudes evolves from the proposition of attitude theorists that individuals' attitudes toward an object (in this case a local area network as an interconnected information system) play an important role in influencing their subsequent behavior toward it (Rivard and Huff, 1988:205). The practical essence of user attitudes in the context of empirical research on information systems implementation is concisely summarized by Ein-Dor and Segev:

> attitudes toward information systems are one of the components of the psychological climate within an organization which determine how users or potential users behave when confronted by the need to interact with some aspect of information systems whether technology itself or those who implement it. (1986:216)

Lucas conducted one of the earliest studies designed to explore and evaluate the relationship between user attitudes and system implementation. He administered a questionnaire to a sample of 616 users in seven manufacturing companies. His findings indicated that the overall system effectiveness, as measured by the input and output quality of the systems, was significantly and positively associated

with general user attitudes toward the computer system in use (1978:36).

Subsequent research by Lucas (1973:165-172) included empirical findings on some 40 organizations and 2900 individuals. Though his research was the most exhaustive and empirically valid of any conducted in those formative years, Lucas concluded: "More research is needed to examine the way in which attitudes relate to implementation success and to determine which attitude components are most crucial" (1978:39).

Two other early researchers who ultimately made lasting contributions to the knowledge and empirical base started by Lucas were Schultz and Slevin. Astutely aware of the rapid pace of information technology development and the severe shortage of research on information system implementation, the researchers devised a Likert-scale instrument which they felt would "provide a meaningful and easily used instrument for data collection" (1974:154). Their instrument was designed to measure system user attitudes to ascertain which attitudes, if any, were related to the successful implementation of an information system (1974:160).

To determine the attitudinal factors associated with the success of an information system and to validate their instrument, they administered their 67-item questionnaire to

106 managers in a large manufacturing company. After using factor analysis to determine the important underlying attitudes, 10 items were discarded, leaving 57-items in the final instrument. In the final analysis, the following seven attitude factors were identified:

1. Performance - The effect on managers' job performance and performance validity.
2. Interpersonal - Interpersonal relations, communication, and increased interaction and consultation with others.
3. Changes - Changes will occur in organization structure and people I deal with.
4. Goals - Goals will be more clear, more congruent to workers, and more achievable.
5. Support/Resistance - Model has implementation support-adequate top management, technical, organizational support and does not have undue resistance.
6. Client/Researcher - Researchers understand management problems and work well with their client.
7. Urgency - Need for results, even with costs involved; importance to me, boss, top management (1974:174-177).

In their validation study, Schultz and Slevin used regression analysis to discover that significant relationships existed between users' perceptions of the system's value and users' attitudes of performance, goals, support/resistance, and urgency.

A myriad of researchers have used and validated the Schultz and Slevin questionnaire, making it one of the most

frequently adopted instruments to measure user attitudes toward an information system. King and Rodriquez conducted a demonstration study involving 45 experienced managers in a simulated business situation to evaluate the effectiveness of an information system. The researchers used the Schultz and Slevin instrument to measure attitudes and value perceptions of systems users. As a result of their study, King and Rodriquez concluded that more organizations and system developers should conduct and report formal information system evaluations (1978:49).

Rodriquez used the instrument to study the effectiveness of different implementation strategies in a laboratory setting (1979:530). He evaluated the association between user attitudes and the use of an interactive decision support system and found that performance (factor 1), goals (factor 4) and urgency (factor 7) were positively related to the "subjects' perceived worth of the system and their actual use of it" (1979:531).

In a comparative study, Robey and Zeller attempted to determine why the implementation of a particular information system was successful in one location and not successful in another location (1978:70). The Shultz and Slevin instrument was used in conjunction with interviews to identify factors impacting these systems. The findings of

their research indicated that the system users of the successful system perceived the attitudes of performance (factor 1) and urgency (factor 7) more favorably than system users of the unsuccessful system 1978:73). Based on these research findings, they concluded that certain attitudes are more important in the success of an information system that others (1978:75).

Robey and Bakr also used the Schultz and Slevin instrument to study user attitudes of travel agency clerks with respect to individual difference in work values and with exposure time to a new system (1978:689). The results of the study demonstrated a strong correlation between job performance and sense of urgency and the success of the system.

Another study makes use of the Schultz and Slevin instrument to probe the relationship between user attitudes and objective measure of system use (Robey, 1979:531). In this study of 66 sales personnel users of a computer-based customer accounting system, Robey found that attitudinal factors of performance (factor 1) and sense of urgency (factor 7) were strongly correlated with discretionary use of the system (1979:535).

Franz, Robey, and Koeblitz used the Schultz and Slevin instrument in the study of an on-line information system in

a sample of 10 banking institutions. As did earlier studies, their findings disclosed a strong relationship between the user attitude factors of performance and sense of urgency and the overall success of each system implementation (1986:14).

The key point of these studies is that the same two attitudes (performance and sense of urgency) were consistently related to the various effectiveness measures of system success. Although there exist strong positive correlations between these specific attitudes as measured using the Schultz and Slevin instrument, it cannot be concluded that these attitudes cause successful system implementation. These findings do, however, provide a significant basis to associate these attitudes with implementation effectiveness and success.

Conclusions

The broad objective of this literature review was to establish a framework for identifying and evaluating the relationships between individual factors and the success of a LAN implementation in the 4950th Test Wing. To accomplish this objective, three distinct areas of the literature were reviewed. The first area introduced the concept of a LAN and described the features and functions of the specific LAN being studied.

The second area focused on acceptance and validation of the user satisfaction construct and instrument as a valid measurement of system effectiveness. User satisfaction is the most frequently adopted and most widely validated measure of system effectiveness. Of the several user satisfaction instruments that have been developed, the Bailey and Pearson instrument has been extensively both in its entirety and as basis for development of shorter form instruments.

The third area addressed the research that has been conducted on the relationship between personal/demographic factors, user attitudes and the effectiveness of an information system. Several researchers have developed empirically validated models which represent the effect of various factors on information system effectiveness. Age, gender, education, and previous computer system experience are personal/demographic factors that can well affect user attitudes and information system effectiveness. Empirical evidence supports the associative relationship between these variables and user attitudes and system success. The empirically validated Likert-scale instrument developed by Schultz and Slevin has received extensive use for measuring user attitudes. Widespread theoretical and empirical evidence supports the positive relationship between user

attitudes and information system effectiveness. Of the many attitudes that exist, the ability of the system to improve job performance was found to be most important, followed closely by urgency of need. Additional factors that may be related to implementation success include goal clarity, interpersonal, relations, organizational change, implementation support and client/researcher relations.

The next chapter will describe the methodology that was used in this study to evaluate the relationship between personal/demographic factors, user attitudes and the success of the 4950th Test Wing LAN.

III. Methodology

Introduction

Chapter I identified the purpose of this study in the form of five research questions which need to be answered. Two of those questions were answered in Chapter II and the remaining three are restated as follows:

Research Question 3

How effective is the 4950th Test Wing LAN as measured by the degree of user satisfaction?

Research Question 4

What is the relationship between user attitudes, user satisfaction, and the effectiveness of the 4950th Test Wing LAN?

Research Question 5

What is the relationship between demographic factors (i.e. age, gender, education, organizational level, and computer/LAN background), user satisfaction, and the effectiveness of the 4950th Test Wing LAN?

This chapter identifies and justifies the methodology used to address the last three research questions.

The chapter is divided into five sections. The first section, Research Design, provides a general description and justification for the data collection methods used in this study. The second section, Data Collection, identifies the process used for the survey distribution, collection and data loading. The third section, Populations and Sample, describes the population and the sample for the study. The fourth section, Research Instrument Development and Analyses

describes the content and structure of the instrument and the methods used to test the validity and reliability of the research instrument. The fifth section, Data Analyses, outlines the statistical analysis methods used in this research to answer the research questions.

Research Design

General Description. A mail census survey was conducted to collect the required data. The authors of this research borrowed liberally from the validated works of previous researchers (Bailey and Pearson, 1983; Ives, Olson, and Baroudi, 1983) to design the survey instrument. The overall design and content of the survey will be discussed in detail in section four of this chapter.

The intent of the survey was to determine the effectiveness (which previous research has indicated as a function of user satisfaction) of a LAN and compare this with the degree of exposure to various individual/organizational factors. The objective was to determine if correlational relationships exist between LAN effectiveness and these factors.

Survey Justification. During initial discussions, the authors identified time, manpower, and sample size as constricting factors in the design of the research

methodology. Recognizing these, only two methods of data collection were considered: interviews and mail surveys.

Interviews. Researchers seem to agree that while interviewing is an excellent data collection method, it is also one of the most difficult to master (Emory, 1991:320; Oppenheim, 1966:30). Oppenheim describes interviewing as an "art or science", and in the hands of a skilled interviewer, the data collected would always outweigh that of a mail survey (1966:30-32). A major problem with interviewing is that in the hands of an unskilled interviewer the data collected is tainted with the possibilities of bias and therefore, is not a valuable resource (Emory, 1991:339; Oppenheim, 1966:31).

Because the sample size exceeded 340 and the time required to screen and interview this size of a sample was prohibiting. For these reasons, interviews were eliminated as a possible method of data collection.

Mail Survey. Although not the ideal method, mail surveys do provide researchers a valuable alternative to interviewing. Emory and Cooper discuss the various advantages and disadvantages of mail surveys (Emory and Cooper, 1991:338-339). A review of the advantages provides some insight on the applicability of mail surveys.

One advantage of the mail survey is that it enables researchers to cover expanded geographic areas (Emory and Cooper, 1991:338). As indicated earlier, the sample size is in excess of 340, and those potential respondents are assigned to various locations on Wright Patterson Air Force Base. Using the base mail system provided the researchers an inexpensive means to contact each respondent.

A second advantage is that surveys require minimum staff to accomplish (Emory and Cooper, 1991:338). This is of particular importance as this research staff consists of just two people. A mail survey is the only method that would enable a small research staff to collect the amount of data required to provide valid analysis.

A third advantage is that mail surveys increase the respondents' feelings of anonymity (Emory and Cooper, 1991:338). A guarantee of anonymity is "critical in obtaining frank and revealing responses..." (Oppenheim, 1966:37).

Although these advantages may lead one to believe that mail surveys are a guaranteed success, the true success comes from how researchers design survey instruments which capitalize on the advantages while overcoming the disadvantages. The following section addresses the

disadvantages of mail surveys and explains how the researchers sought to minimize them.

Data Collection

The data collection process used in this research consisted of mail surveys sent to all members of the population. The actual collection process can be divided into three phases: instrument distribution, instrument collection, and data loading.

Instrument Distribution. When performing a census survey, an accurate accounting of the population is vital (Parten 1950:110). As a standard practice, all information systems administrators maintain an authorized user list. The researchers obtained copies of these lists from the system administrators of the four systems studied. These lists ensured accurate accounts of all registered users.

After the lists were obtained, the researchers developed address labels and packaged the survey. The survey package included: a cover letter signed by the Commander, 4950th Test Wing, a copy of the questionnaire, an answer sheet, and a pre- addressed return envelope. The packages were then mailed to each respondent.

Instrument Collection. A major concern of any research is the response rate. For this research, various steps were taken to improve response rates. The return envelopes

described above were one method used to improve returns, others include; cover letter, preliminary notifications and follow-up messages.

Cover Letter. Although very little research has been focused on how cover letters affect response rates (Emory and Cooper, 1991:335), the researchers decided to add a cover letter signed by the Commander, 4950th Test Wing. This letter highlighted the positive aspects of participation and explained the benefits of frank, accurate responses. In addition, this letter contained a guarantee of anonymity.

Preliminary Notification. Emory and Cooper state that "evidence indicates that advance notifications are effective in increasing response rates" (1991:334). Preliminary notifications were made by sending a broadcast message over the LAN E-Mail system. This broadcast method displayed the preliminary notification message, on the user screen, during the login process. The message advised all users of the purpose of the survey as well as an appeal for their support.

Follow-up Messages. Emory and Cooper also state that follow-ups are "almost universally successful in increasing response rates" (1991:334). For the purposes of this research, two different follow-up messages were

planned. The first message was broadcast over the LAN E-Mail system. This message was in the form of a "thank you" message to those whom already returned the survey and a reminder to those whom had not yet completed the survey. The message reiterated the positive aspects of completing the survey.

An additional follow-up was planned by the researchers in the event the initial response rate was lower than the 30 percent which is considered satisfactory (Emory and Cooper, 1991:333). Prior to distribution, the serial number of each answer sheet was cross-referenced to the user lists. Using this method, in the event responses were under 30 percent, researchers could identify only those users who failed to return the survey. A second survey package could then be sent only to those users. The initial response for this survey was 50 percent and this secondary follow-up proved unnecessary.

As discussed before, each survey was packaged with a pre-addressed return envelope. These envelopes were addressed to the researchers, in care of the appropriate system administrators. In an effort to further ensure the respondents' feelings of anonymity, there were no markings on these envelopes, other than the address label. The researchers personally collected the completed surveys in an

attempt to eliminated the possibility of return surveys getting lost in the base distribution system.

Data Loading. Once all the surveys were collected, the researchers visually checked each answer sheet for stray marks, poor erasure, or any other condition which would prevent accurate scanning by the optical reader. The tabulated results were then loaded into a SAS database to which all statistical analyses could be applied. Unscannable response sheets identified during prescreening were manually added to the database.

Population and Sample

The subjects of this research consisted of the 345 registered users of the 4950th Test Wing LAN. The subjects were dispersed in four physically separate geographic locations. In addition to the physical locations, the subjects were divided along functional lines. The 4950th Test Wing headquarters, staff support and maintenance divisions are located in Area A, Wright Patterson Air Force Base, OH. The remaining users are located in Area C, Wright Patterson Air Force Base, OH.

Confounding Variables. This research evaluated four distinct LAN systems. Each system was similar in many respects and different in others. While the similarities do not have an additional impact on this study, however the

differences may introduce confounding variables and therefore require mentioning here.

Of the four LANs, only one (4950 Test Wing Aircraft Modification Division) provided an E-Mail application software package (Moran, 1993). The other three LANs used the VAX mainframe computer E-Mail (Harris, 1993; Lizardi, 1993; Shires, 1993). Application software packages are generally more user friendly than mainframe systems and thus may affect user satisfaction.

One of the LANs (4950 Test Wing Flight Test Engineering Division) is a mainframe-based system rather than a PC-based LAN (Lizardi, 1993). This system provides the users more computing power but is less user friendly (Lizardi, 1993).

Finally, a major difference is that each LAN is managed by different system administrators, each with distinct management styles.

For the above reasons, the researchers decided to divide the study into four groups and evaluate each separately as well as combined.

Sample Selection. For the purpose of this research, a census survey was used (survey 100 percent of the population). Most researchers (Emory and Cooper, 1991; Oppenheim, 1966; Parten, 1950) agree that the main reasons for taking a sample are time and cost. Parten provides the

most detailed discussion of the advantages of sampling over census. He maintains that sampling can provide estimated population characteristics in a shorter period of time and is typically much less expensive than complete enumeration (1950:109). The researchers took these factors into account when designing the data collection procedures.

There were two factors which convinced the researchers to select a census survey. First, the population itself was relatively small (345). Assuming a 30-50 percent response rate, a census survey would ensure a larger data base on which to conduct research analysis. Second, the researchers strongly felt that, considering the significant resources in LAN operations, the most comprehensive possible accounting process should be used.

Research Instrument Development and Analyses

The survey created for this study was derived from the previous studies outlined above (Schultz and Slevin, 1975:160; Bailey and Pearson, 1983:539-543). The validity and reliability of the questions are well supported in the literature, however, additional statistical analysis is required to ensure the instrument is valid and reliable. The following section describes the format of the questionnaire and the analytical methods used to test the validity and reliability of the instrument.

Development. The questionnaire (Appendix A) was divided into three parts: background/demographic information, users' satisfaction with the local area network, and user attitudes concerning the local area network.

Questionnaire Part I. The first part of the questionnaire contained nine questions regarding subject demographic information. The demographic variables of interest included the user's age, education level, gender, number of people supervised, professional category (i.e. officer, enlisted, civilian), pay grade, and previous computer and LAN experience. These Part I questions were structured for multiple choice, categorical responses.

Questionnaire Part II. The second part of the questionnaire requested the respondent's degree of satisfaction with the 4950th Test Wing local area network. The 14 items in this section were adapted from the instrument developed by Pearson and Bailey (1983:539) and later refined by Tan and Lo (1990:204) to measure user information satisfaction.

According to Bailey and Pearson, when using the instrument in specific applications, "it is reasonable to remove irrelevant factors and redefine the factors in

situation specific terms" (1983:538). The instrument developed for this research study consists of 13 relevant "factor" items which have been slightly redefined to align with this study's specific focus. A 14th item was added to measure the overall degree of satisfaction of the respondent with his/her present local area network experiences. This part of the questionnaire used a seven-point Likert-type scale for the responses, with "1" representing the least satisfaction, "7" representing the most satisfaction, and "4" representing mixed feelings (about equally dissatisfied as satisfied).

Questionnaire Part III. The third part of the questionnaire asked for the respondent's opinions regarding various aspects of the 4950th Test Wing LAN. This section was adopted from the Schultz and Slevin questionnaire which was developed to measure attitudes of information system users (1975:174-177). Their questionnaire consists of 56 statements about various aspects of an information system.

In order to refine the questions in LAN specific terms, minor changes were required. Only 36 of the original statements were used to make this section relevant to LAN users. Another revision was that the name local area network was substituted for the name Forecast (Forecast was

the name of the information system that Schultz and Slevin studied in their research). Finally, the tense of the original questionnaire statements in the Schultz and Slevin instrument was changed from past to present.

The statements in this part use a five-point Likert-type scale for the responses. A response of "1" reflects the strongest level of disagreement, "5" represents the strongest level of agreement, and "3" represents uncertainty.

Questionnaire Structure and Research Variables. The questionnaire was designed to specifically address the research variables identified in the research questions. Research question 3 contains the criterion or dependent variable--the overall effectiveness of the 4950th Test Wing LAN as subjectively measured by the degree of user satisfaction. The items included in Part II of the questionnaire are designed to measure this variable.

Research question 4 contains the predictor or independent variable--user attitudes. The statements included in Part III of the instrument are designed to measure this variable.

Research question 5 contains a second set of predictor variables--age, gender, education level, organizational

level, and computer/local area network background. Part I of the questionnaire identifies these variables.

Research Instrument Validation. This section examines the internal validity of the research measurement instrument used in this study. A measurement instrument is said to be valid to the extent that differences found between variables studied reflect true differences among those variables (Emory and Cooper, 1991:179). That is, does the instrument really measure what it is designed to measure?

Traditionally, two different categories of internal validity are examined: 1) content validity and 2) construct validity. Content validity implies that all aspects of the attribute being measured are considered by the instrument. Thus, the measurement is complete and sound (Bailey and Pearson, 1983:535). Construct validity implies that the measurement instrument performs as expected relative to the construct of the attribute being measured (Bailey and Pearson, 1983:535).

In this study, the researchers wished to assess how well the three-part questionnaire actually measures user satisfaction and user attitudes toward the LAN. The questionnaire items included in this study have been extensively used and validated in studies by other researchers.

Questionnaire Part I Validity Analysis. Part I of the questionnaire used a nominal scale to measure basic demographic data and therefore, needs no validation.

Questionnaire Parts II/III Validity Analysis. To confirm the construct validity of the questions contained in Parts II and III of this instrument, confirmatory factor analysis was performed. According to Campbell, factor analysis of the components making up the total measure is an important method of construct validation (Baroudi and Orlikowski, 1988:48).

The Bailey and Pearson instrument, which was used as the basis for Part II of this research, has been widely used and validated by other researchers. The Bailey and Pearson instrument was tested initially by Bailey and Pearson (1983:533). Since then, it has also been empirically tested by Tan and Lo (1990:203), Baroudi and Orlikowski (1988:44), and Baroudi, Olson and Ives (1986:232). These studies have yielded significantly valid, reliable, and consistent results. In each of these studies, factor analysis was performed to determine if all questions actually measured the underlying variable of user satisfaction.

The validity of the Schultz and Slevin instrument, used as the basis for developing Part III of this study's questionnaire, has been widely tested and supported by

several researchers. Tested initially by Schultz and Slevin (1975:54), the instrument has since been revalidated by McMullin (1985:50), Moshner and Nightengale (1984:73), Robey (1979:527), Robey and Bakr (1978:689), Robey and Zeller (1978:70), and Rodriquez (1977:37). Factor analysis procedures were also used in each of these studies because the original instrument had been adapted and changed to satisfy the researchers unique requirements.

Factor analysis refers to a variety of statistical techniques which look for patterns among the variables to discover if an underlying combination of the original variables (a factor) can summarize the original set. The primary objective of factor analysis is to reduce a large number of variables to some smaller number by determining which belong together and seem to measure the same thing (Emory and Cooper, 1991:649).

The research questionnaire used in this study consisted of 59 questions--9 measuring demographic data, 14 measuring the degree of user satisfaction with the LAN, and 36 questions measuring user attitudes. Questions pertaining to user satisfaction were not identical to those measuring user attitudes, and therefore, do not measure the basic underlying dimensions to the same extent. Factor analysis enabled the researchers to identify and validate the

individual dimensions being measured by the survey. (Hair and others, 1979:211).

The specific reason for using factor analysis in this study was to (Tabachneck and Fidell, 1983:111-113):

1. Condense and analyze the patterns of intercorrelations between the set of questions contained in Parts II and III of the questionnaire.

2. Reduce the large number of questions in the set of questions contained in Part III of the questionnaire to a smaller number of more meaningful dimensions or factors.

The first step in factor analysis involves calculating the interrelationships (correlations) among the questions in each set (Kim and Mueller, 1988:23-24). Using R-factor analysis, correlation coefficients are calculated. These coefficients are a measure of the relationship between one question and another.

The second step is the construction of a new set of variables based on the relationships in the correlation matrix. This transformation is achieved using principal component analysis. This statistical approach, transforms a set of variables into a new set of composite variables or principal components that are independent and are not correlated with one another (Kim and Mueller, 1988:35). These linear combinations referred to as factors, account for the variance in the data as a whole. The single best

linear combination makes up the first principal component and is the first factor. The second factor is defined as the best linear combination of variables which accounts for the proportion of the variance that is not accounted for by the first factor. Subsequent factors, each being the best linear combination of variables not accounted for by the previous factors, are defined in the same manner until all of the variance in the data has been explained (Emory and Cooper, 1991:549-650).

The third and final step in factor analysis is factor rotation to achieve the best *fit* or *load* of factors with the data. Factor rotation entails locating a pattern in which one factor would be heavily loaded on some variables and a second factor on others, and so on. Such a condition would suggest rather *pure* constructs underlying each factor (Emory and Cooper, 1991:650).

The procedure PROC FACTOR in Statistical Analysis Software (SAS) (Schlotzhauer and Littell, 1987:432-465) was used to perform the factor analysis. For the purpose of this study, pertinent statistics generated by this procedure included factor loadings for each underlying factor identified.

According to Hair and others, "A factor loading represents the correlation between an original variable and

its respective factor" (1979:234). Associated with each combination of variable and factor, there is a factor loading value which ranges in value from -1.0 to +1.0. The larger the absolute value of the factor loading, the more significant the correlation between the variable and the factor. The amount of variance that a variable has in common with the factor is determined by squaring the factor loading value. As a general rule, absolute factor loadings above 0.3 are considered significant (Hair and others, 1979:234). The researchers used 0.3 as the minimum absolute factor loading for establishing whether a variable should be included in the study. Any variable that did not load on any factor at the 0.3 absolute factor loading level or higher was eliminated from the study.

Research Instrument Reliability. According to Emory and Cooper (1991:185), a measurement instrument is reliable to the extent that it produces consistent results which are free from error. Reliability testing statistically estimates the degree of instrument error. Parts II and III of this study's questionnaire consist of items adopted from previously tested research instruments. As noted above in reference to instrument validity, previous reliability results alone are not statistically sufficient bases for

universal application if significant changes are made to the content and structure of the instrument.

Questionnaire Parts I/II/III Reliability Analysis. Reliability refers to the extent to which the data reflect internal consistency, that is, how accurate on the average, the estimate of the true score is, in a population of objects to be measured (Baroudi and Orlikowski, 1988:50). Cronbach's coefficient alpha was the specific measure of reliability used in this study. The SAS procedure PROC CORR ALPHA (Schlotzhauer and Littell, 1987:258) was used to calculate the coefficient.

Historically, both the Bailey and Pearson instrument and the Schultz and Slevin instrument have proven to be highly reliable. Originally, the Bailey and Pearson 39 item questionnaire, the basis for 14 questions included in Part II of the questionnaire, was statistically tested to estimate measurement errors. The analysis of variance method was used by Bailey and Pearson, and resulted in an average reliability coefficient of .93, with .75 being the lowest coefficient of the 39 items (1983:583). For the purpose of research, a reliability coefficient of .70 or higher is acceptable (Tan and Lo, 1990:205). The high reliability coefficient strongly supports the overall reliability of the Bailey and Pearson instrument.

Tan and Lo, who used a modified version of the original Bailey and Pearson instrument, tested their measurement instrument using the split-halves method. The reliability coefficient using this method was .94. To further support the reliability of their instrument, they tested using the internal consistency method and recorded a .96 inter-item reliability coefficient (1990:205). Both results certify the reliability of the Tan and Lo survey instrument.

Baroudi and Orlikowski used the Bailey and Pearson questionnaire as a basis to develop a "short form measure of user information satisfaction" (1988:44). These researchers reduced the original questionnaire to 13 items. They assessed the new instrument's reliability using Cronbach's coefficient alpha to estimate the internal consistency of the questions in each factor. Cronbach's alpha has the most utility for multi-item scales at the interval level of measurement (Emory, 1991:187). All the reliabilities for the 13 factors were above the .70 level required for research purposes (Baroudi and Orlikowski, 1988:50). This analysis provides evidence that the instrument is internally consistent and, therefore, reasonably free of measurement error.

The Schultz and Slevin instrument, which was used as the basis for Part III of the questionnaire in this

research, has been extensively tested to assess its reliability. The instrument was initially tested by Schultz and Slevin (1975:102) using the internal consistency method. Cronbach's coefficient alpha was calculated at .92, supporting the instrument's reliability. Several other researchers including Robey, Robey and Bakr, Robey and Zeller, and Rodriquez, have empirically tested the Schultz and Slevin instrument for reliability and have estimated similar reliability scores (Moshner and Nightengale, 1984:92).

Pilot Test. A pilot test was performed to detect errors and weaknesses in the design of the research instrument and survey implementation procedures. The researchers administered a pretest using the developed questionnaire to a sample of 15 subjects. As a result of the pretest, subject inputs regarding question content and composition were evaluated and, where appropriate, incorporated into the refined questionnaire. For example, question 11 of the original questionnaire, dealing with the accuracy and correctness of the information output by the LAN was removed from the final survey. Forty percent of the pretest participants either failed to answer it, or answered it and made comments concerning their confusion with the wording.

Data Analyses

This section describes the statistical methods used to answer research questions 3, 4, and 5. First, an analysis of means was performed to answer research question 1 as to the effectiveness of LAN. This was succeeded by the performance of an analysis of variance procedure to determine if there were significant differences between the means measuring user satisfaction among the four sample groups within the population. Following that, correlational and regression analysis (bivariate and multiple) techniques were used to analyze the data and answer research questions 4 and 5.

Assumptions. The statistical techniques used in this study make four assumptions of the data (Parson, 1986:607). They are:

1) Each set of values for the dependent variable for a given combination of independent variables adheres to a normal distribution.

2) The correlation and regression lines of the dependent variable and the independent variables are linear.

3) All sets of values for the dependent variables have the same variance.

4) The level of data used was at least interval scale.

To detect departures from the first three assumptions, regression residuals were calculated. A residual value is

calculated by taking the difference between the actual value of the dependent variable and the predicted value of the dependent variable generated by the regression model. The SAS procedure PROC REG RESIDUAL PLOT was used to produce a scatterplot graph depicting the shape of the actual vs. predicted residual relationship. For purposes of this research, the Likert scale was treated as an interval scale. Emory and Cooper state that data obtained using Likert-type scales can be considered interval-level (1991:222).

Analysis of Means. The mean is the most popular and best understood statistical measure of central tendency for a quantitative set of data. The mean for a data set is simply equal to the sum of the measurements divided by the number of measurements contained in the data set (McClave and Benson, 1991:83).

The mean was calculated for Factor 1 (User Satisfaction) to measure the effectiveness of the LAN. A total of five mean calculations were performed, one for each of the four sample groups (i.e. 4950th TW/AM/FF/MA/SC) and the entire population. The PROC UNIVARIATE procedure within SAS was used to compute each mean value and the associated standard deviation. This method enabled the researchers to assess the global degree of user satisfaction and thus to answer research question 3.

Analysis of Variance. To determine whether the means of the four sample groups in this study differed significantly from each other with respect to the dependent variable, level of user satisfaction, the researchers used the PROC ANOVA procedure within the SAS to calculate the analysis of variance. Analysis of variance is a method for testing the hypothesis that several different groups all have the same mean for the variable being measured.

The mean of a sample is often used to estimate (make an inference about) the population mean for a given variable data set. The predictive quality of a sample mean is directly dependent upon the size of the sample taken from the population and the variability of the data. If the population distribution contains extreme scores, large or small, sample means can be misleading (Emory and Cooper, 1991:252). It is not enough to simply compute the group means and examine whether or not they are different. While the means differ in numerical values it is still necessary to investigate whether the differences are simply random variations that occurred by chance, or whether there are systematic differences between the means (Iversen and Norpoth, 1976:25-26). If the statistical analysis of separate sample groups reveals that there is no significant difference between sample means then there is no need for

further analysis. The sample means are statistically identical and can be collectively analyzed. If however, significant differences exist, then each of the samples that differ must be treated as separate populations and must be analyzed accordingly.

Correlational Analysis. Correlational analysis is a statistical method used to calculate an index to measure the nature of the relationship between variables (Emory and Cooper, 1991:582). Correlation measures the closeness of a linear relationship between two variables. Two variables are said to be correlated when a change in the value of one of the variables tends to be associated with a consistent corresponding change in the value of the other. (Parsons, 1988:607).

The procedure PROC CORR was used to calculate the Pearson Correlation Coefficients for all variable relationships. This procedure outputs a correlation matrix which reflects the overall r-value for two-variable relationships and the p-value of significance.

Regression Analysis. A correlation coefficient documents that a relationship between variables exists, but it says nothing about the form of the relation between the variables. Regression analysis is a statistical method which investigates the form of the relation between the

variables. The objective of regression analysis (bivariate and multiple) is to "examine the strength of association between the single dependent variable and the one or more independent variables" (Hair and others, 1979:36).

This study sought to analyze two potential variable relationships. They include:

1. The relationship between the effectiveness of the 4950th Test Wing LAN and the combined set of factors measuring attitudes of LAN users; the analysis of this relationship revealed which of the attitude factors as a combined set of variables were significant predictors of effectiveness.

2. The relationship between the effectiveness of the 4950th Test Wing LAN and each of the demographic variables; the analysis of this relationship revealed which of the demographic variables (individually) were significant predictors of effectiveness.

The dependent variable of interest in this study was the effectiveness of the 4950th Test Wing LAN. This variable was calculated by using the set of questions from Part II of the questionnaire. Factor and reliability analysis were employed to determine which of the questions, used as a combined set, most precisely measured the effectiveness of the 4950th Test Wing LAN. The actual value of the dependent variable was computed by averaging the responses to the questions selected from Part II of the questionnaire.

The independent variables for this study were: 1) each of the attitude factors determined through factor analysis and 2) each of the demographic variables as calculated using the information compiled from Part I of the questionnaire (age, gender, organizational level, education level, and computer/LAN experience level).

In constructing the regression model, the goal of the analysis was to limit the number of independent variables so that the "inclusion of an additional independent variable would not significantly increase the accuracy of the model" (McMullin, 1985:60). The SAS procedure PROC REG was used to conduct a bivariate or simple linear regression to determine 1) which of the attitude factors (individual) are statistically significant predictors of the effectiveness of the 4950th Test Wing LAN, and 2) which of the demographic variables (individual) are statistically significant predictors of the effectiveness of the 4950th Test Wing LAN.

Next, the SAS procedure PROC REG STEPWISE was used to conduct a multiple linear regression to determine which combinations of attitude factors and demographic variables are statistically significant predictors of the effectiveness of the 4950th Test Wing LAN.

Chapter Summary

The purpose of this chapter was: 1) to provide an overview of the data collection process; 2) identify the population and samples of the study; 3) to describe the content and structure of the research instrument and to explain the methodologies used to analyze the validity and reliability of this instrument; 4) to describe the statistical data analyses procedures used to answer research questions 3, 4, and 5.

The researchers used a mail census survey to collect the research data. The population for the study was all LAN users in the 4950th Test Wing. Four sample groups within the population were identified and included the 4950th Test Wing/SC/MA/FF/AM. Factor analysis was the primary methodology used to test the construct validity of the instrument and to select a smaller set of variables within the larger set contained in Part III (User Attitudes) of the questionnaire. To measure the instrument's reliability, SAS was used to calculate the Cronbach Coefficient Alpha reliability measure. A pilot test was then administered to examine the empirical design of the instrument. Next, the SAS procedure PROC UNIVARIATE was performed to calculate the means and standard deviations for each of the four sample groups and the entire survey popluation to determine the

effectiveness of the LAN. To explore for possible differences in the sample means with respect to the dependent variable, an analysis of variance using the SAS procedure PROC ANOVA was conducted. Finally, both correlational and regression analysis were performed to ascertain the direction and magnitude of the relationships between the dependent and independent variables. The next chapter will report the findings and analysis of this study.

IV. Findings and Analyses

Introduction

This chapter contains four sections. The first section addresses the survey response rate. The second section analyzes the data characteristics of the survey findings. The third section reviews the results of the instrument validity and reliability analyses. The fourth section reports the results of the data analyses performed on the research data.

Survey Response Rate

Three hundred and seventy questionnaires were distributed to four different operating divisions within the 4950th Test Wing. A total of 173 were answered and returned, which represents a total response rate of 47 percent. Of the original 370 questionaires, 28 were returned due to permanent reassignment of the addressee. Eliminating these from the total number distributed resulted in an effective response rate of 51 percent.

A comparison of the usable responses categorized by each division is depicted in Table 2. The results indicate that each of the four divisions had good response rates with minimal variation.

Although 173 surveys were available for use, some contained missing data (i.e., an occasional unanswered question). In each statistical test, missing data was deleted listwise; that is, the entire survey was deleted from the analysis if

TABLE 2

COMPARISION OF THE NUMBER OF QUESTIONNAIRES DISTRIBUTED AND THE NUMBER OF RESPONSES RECEIVED

Organization	Sample Size	Surveys Returned	Response Rate (%)
4950TW/AM	109	57	52
4950TW/MA	91	43	47
4950TW/FF	84	45	54
4950TW/SC	58	28	48
Total	342	173	51

any of the variables being analyzed had a missing response. Therefore, the statistical analyses report varying numbers of cases.

Data Characteristics

The research instrument (Appendix A) consisted of 59 items sub-divided into three parts. Part I contained the demographic items (1 to 9). Part II contained 14 items (10 to 23) which measured the level of respondents' satisfaction with the system. Part III contained 36 items (24 to 59) which measured the respondents' attitudes toward the 4950th Test Wing LAN. The raw data collected from the 173 surveys

is contained in Appendix B. The data characteristics are summarized for each division and the entire sample in the following paragraphs.

Age. The age of the respondents was classified into seven age groups. This classification is documented in Table 3 for each individual division and the entire sample population.

TABLE 3

AGE OF RESPONDENTS BY GROUP

Category	Group AM	Group FF	Group MA	Group SC	Entire Sample
Less than 20	0	0	0	0	0
20 to 25	1	2	5	2	10
26 to 30	8	15	5	2	30
31 to 40	16	13	14	7	50
41 to 50	23	12	14	13	62
51 to 60	9	2	5	4	20
More than 60	0	1	0	0	1
Total	57	45	43	28	173

This demographic ranges from zero percent in the youngest age group (less than 20) to a high of 35.8 percent in the 41 to 50 age group. Of the complete sample, 82 percent of the respondents were between the ages of 25 and 50.

Education Level. The education level of 4950th Test Wing LAN users aligned into five categories as shown in Table 4. The percentage of users in each category ranged

from a low of 10.4 percent with a high school diploma or GED to a high of 24.3 percent with an undergraduate degree. The data revealed that 58.4 percent of the users had less than a bachelor's degree while the remaining 41.6 had been awarded an undergraduate or graduate degree.

TABLE 4

EDUCATION LEVEL OF RESPONDENTS BY GROUP

Category	Group AM	Group FF	Group MA	Group SC	Entire Sample
High school graduate or GED	3	2	11	2	18
Some college work	29	2	17	13	61
Associate degree	8	3	9	2	22
Undergraduate degree	11	22	3	6	42
Graduate degree	6	16	3	5	30
Missing response					
Total	57	45	43	28	173

Gender. Table 5 shows the gender of survey respondents. Data analysis indicates that the clear majority of 4950th Test Wing LAN users are male. Males comprised 76.2 percent of this study's sample population and females comprised 23.8 percent.

TABLE 5

GENDER

Category	Group AM	Group FF	Group MA	Group SC	Entire Sample
Male	39	40	38	14	131
Female	18	5	5	13	41
Total	57	45	43	27	172

Supervisory Span of Control. The number of people supervised by each LAN user is documented in Table 6. A large percentage (68.8 percent) of sample respondents did not supervise anyone. A full 96 percent of LAN users supervised 10 people or less.

TABLE 6

NUMBER OF PEOPLE *SUPERVISED*

Category	Group AM	Group FF	Group MA	Group SC	Entire Sample
None	41	34	23	21	119
1 to 5	3	5	11	6	25
6 to 10	10	6	5	1	22
11 to 15	3	0	2	0	5
16 to 20	0	0	2	0	2
21 or more	0	0	0	0	0
Total	57	45	43	28	173

Respondents' Rank Category. The rank categories for respondents were divided into six categories as delineated in Table 7. Data analysis revealed that 70.5 percent of the population were civilian employees and 29.5 were military

TABLE 7

RANK CATEGORY OF RESPONDENTS

Category	Group AM	Group FF	Group MA	Group SC	Entire Sample
Officer	9	12	0	3	24
Enlisted	0	0	22	5	27
Civilian (GS)	34	25	9	17	87
Civilian (WG)	6	2	9	0	15
Civilian (GM)	4	4	1	3	12
Non-appropriated fund (NAF)	4	2	2	0	8

members. The largest proportion within the sample (50.3 percent) was general schedule (GS) civilian employees.

Respondents' Pay Grade. Table 8 shows the pay grades for respondents. A significant proportion (34 percent) are in the 3-6 pay grade category (e.g., E-3 through E-6, O-3 through O-6, GS-3 through GS-6, etc.). The majority (51.4 percent) are in pay grades 11-15.

TABLE 8

PAYGRADE OF RESPONDENTS

Category	Group AM	Group FF	Group MA	Group SC	Entire Sample
1 to 2	4	3	1	1	9
3 to 4	6	9	3	2	20
5 to 6	11	3	17	8	39
7 to 8	1	0	4	3	8
9 to 10	1	1	3	2	7
11 to 12	22	18	12	10	62
13 to 15	12	10	3	2	27
Total	57	44	43	28	172

Prior Computer Experience. The length of experience respondents had with computers prior to using the 4950th Test Wing LAN is divided into six categories in Table 9. The data reflects a relatively strong computer experience base among the LAN users, with 76.9 percent of respondents reporting one or more years experience. A significant percentage of users (43.9 percent) had more than five years of computer experience.

TABLE 9

PRIOR COMPUTER EXPERIENCE

Category	Group AM	Group FF	Group MA	Group SC	Entire Sample
Less than 3 months	9	2	5	5	21
3 to 6 months	0	2	1	0	3
6 to 12 months	0	2	12	1	15
1 to 2 years	6	3	6	1	16
3 to 5 years	13	14	11	7	45
More than 5 years	28	22	8	17	72
Invalid Response	1	0	0	0	1
Total	57	45	43	28	173

Prior LAN Experience. The amount of experience respondents had with LANs prior to using the 4950th Test Wing LAN is also classified into six categories in Table 10. A large majority of users reported having less than three months prior experience using LANs. Only 25.4 percent reported having one year or more of experience, with a mere 5.2 percent having more than five years experience.

TABLE 10

LAN EXPERIENCE OF RESPONDENTS

Category	Group AM	Group FF	Group MA	Group SC	Entire Sample
Less than 3 mos	39	23	34	22	118
3 to 6 months	1	5	1	0	7
6 to 12 months	0	2	2	0	4
1 to 2 years	3	6	4	2	15
3 to 5 years	10	5	2	3	20
More than 5 years	4	4	0	1	9
Total	57	45	43	28	173

New LAN Experience. Data results collected on respondents' experience with the 4950th Test Wing LAN are annotated in Table 11. The table consists of six categories ranging in duration of experience from less than one month to more than six months. The majority (57.6 percent) of users had more than 6 months, while 19.7 percent had less than one month experience.

TABLE 11

EXPERIENCE WITH NEW LAN

Category	Group AM	Group FF	Group MA	Group SC	Entire Sample
Less than 1 month	12	2	4	0	18
1 to 2 months	16	0	0	0	16
3 to 4 months	4	2	8	2	16
5 to 6 months	3	4	8	7	22
More than 6 months	21	36	23	19	99
Invalid Response	1	0	0	0	1
Total	57	44	43	28	172

Research Instrument Validity and Reliability

This section reports the results of the statistical analysis performed to assess the research instrument's validity and reliability.

Research Instrument Validation. The responses to Parts II (User Satisfaction) and III (User Attitudes) were factor analyzed to determine whether the items included in Parts II and III actually measure user satisfaction and user attitudes. Additionally, factor analysis was performed to determine whether there exists some smaller set of user satisfaction and attitude factors which effectively measure these constructs.

Factor Analysis - Part II. Items 10 through 23 of Part II were used in previous research instruments to quantify the effectiveness of information systems. To validate that this study's population perceived these items as did previous populations, a factor analysis was performed on the responses to these items. The results of the factor analysis confirmed that 11 of the 14 items measured user satisfaction. In addition to these 11, item 42, which in previous studies measured user attitudes, was also perceived as a measure of user satisfaction.

Items 10, 11, 12, 13, 14, 16, 18, 20, 21, 22, 23, and 42 loaded significantly as a measure of user satisfaction

(Factor 1). The remaining three items (15, 17, and 19) loaded significantly as a measure of user attitudes and will be discussed in the following section. An analysis of the content and wording of all user satisfaction items confirmed that these items measured user satisfaction of the LAN. All final factor loadings (Table 14) for user satisfaction were significantly higher than the .30 minimal threshold (Hair and others, 1979:234).

In conclusion, the factor analysis results validated that these items were perceived by respondents to measure user satisfaction. Therefore, these results support the construct validity of the research instrument.

Factor Analysis - Part III. In addition to user satisfaction, user attitudes had to be quantified for the regression analysis used to answer the research questions. The 36 items in Part III of the instrument (25 to 59) measure various user attitudes. Confirmatory factor analysis of the responses was used to validate this part of the instrument and to reduce the number of variables to a smaller and more manageable set of factors.

The final factor solution for the measure of user attitudes confirmed the existence of seven underlying factors of user attitudes. Because the factor loadings for all of the user attitude items included in the survey

TABLE 12

FACTOR LOADINGS FOR USER SATISFACTION
(FACTOR 1)

Item Number	Item	Loading
10	The relevancy and usefulness of the products and services provided by the local area network.	0.82
11	The reliability and dependability of the local area network.	0.80
12	The ease of using the local area network.	0.70
13	The time it takes the local area network to provide a service or complete an action.	0.75
14	The safeguarding of data from misappropriation or unauthorized alteration or loss.	0.59
16	The features and services provided by the local area network.	0.78
18	The balance between the cost and the usefulness of the local area network.	0.55
20	The changes in job freedom and job performance resulting from the local area network.	0.46
21	The capacity of the local area network to change or adjust in response to new conditions, demands, or circumstances.	0.67
22	The ability of the local area network to communicate/transmit data within the network.	0.79
42	The local area network is technically sound.	0.65

exceeded the minumum criteria of .30 (Hair and others,1979:234), no items were eliminated based on the factor analysis results. An evaluation of the content of the items, as aligned in the factor analysis, was then conducted to determine a suitable classification for each factor. Classification selection was also influenced by classifications used by previous researchers in administering the Schultz and Slevin instrument (Robey, 1979:537; Robey and Bakr, 1978:699-701; Robey and Zeller, 1978:70-78; Schultz and Slevin, 1975:174-177). The resulting seven factor classifications are described in the following paragraphs.

Job Performance (Factor 2). Factor 2 was comprised of 12 items. The factor loadings and items that comprised Factor 2 are listed in Table 13.

The content of a majority of the items in this factor addressed the impact of the LAN on improving job performance. Consequently, the factor was classified "job performance."

Sense of Urgency/LAN Importance (Factor 3). Comprised of six items, Factor 3 describes the attitudes of users on their sense of urgency toward implementing the LAN and how important it is to them. The factor loadings and items for Factor 3 are listed in Table 14.

TABLE 13

FACTOR LOADINGS FOR JOB PERFORMANCE
(FACTOR 2)

Item Number	Item	Loading
27	I have more control over my job.	0.83
28	I am able to improve my performance.	0.81
31	I am able to see better the results of my efforts.	0.79
24	My job is more satisfying.	0.79
26	It is easier to perform my job.	0.75
25	Others can better see the results of my efforts.	0.73
32	The accuracy of my work is improved as a result of using the local area network.	0.72
30	The local area network makes my job easier.	0.68
33	The division/directorate/section performs better	0.61
29	Others are more aware of what I am doing.	0.57

All items in this factor describe the importance of the LAN, from the users perspective, as well as how the user feels about implementing the LAN as soon as possible. To account for these concepts, the factor was classified "sense of urgency/LAN importance."

TABLE 14

FACTOR LOADINGS FOR SENSE OF URGENCY/LAN IMPORTANCE (FACTOR 3)

Item Number	Item	Loading
27	I have more control over my job.	0.83
28	I am able to improve my performance.	0.81
31	I am able to see better the results of my efforts.	0.79
24	My job is more satisfying.	0.79
26	It is easier to perform my job.	0.75
25	Others can better see the results of my efforts.	0.73
32	The accuracy of my work is improved as a result of using the local area network.	0.72
30	The local area network makes my job easier.	0.68
33	The division/directorate/section performs better	0.61
29	Others are more aware of what I am doing.	0.57

Interpersonal Relations (Factor 4). The next factor was comprised of five items and was classified "interpersonal relations." With the exception of item 40, all items within this factor clearly focused on the impact of the LAN implementation on the user's interpersonal relations on the job. While item 40 had a somewhat low

TABLE 15

FACTOR LOADINGS FOR INTERPERSONAL RELATIONS (FACTOR 4)

Item Number	Item	Loading
37	I need to talk with people more.	0.81
36	I need to consult others more often before making a decision.	0.77
34	I need to communicate with others more.	0.77
35	I need the help of others more.	0.69
40	Individuals set higher targets for performance.	0.48
39	I have had to get to know several new people.	0.46

factor loading, which might explain its poor association relative to the other items, it was not low enough to eliminate the item. The factor loadings and items for this factor are listed in Table 15.

System Understanding and Training (Factor 5). This factor was comprised of four items. Three of these items (6, 8, and 10) were originally aligned under Part II of the survey as user satisfaction measures. A review of their composition reveals a strong emphasis on measuring the extent of user training and user understanding of the system. The fourth item also focuses on user attitudes

TABLE 16

FACTOR LOADINGS FOR SYSTEM UNDERSTANDING AND TRAINING (FACTOR 5)

Item Number	Item	Loading
15	The formal instructions for using the local are network (extremely dissatisfied-extremely satisfied) me.	0.71
50	People are given sufficient training to utilize the local area network.	0.69
19	The amount of specialized instructions and training provided (extremely dissatisfied-extremely satisfied) me.	0.68
17	The degree to which I understand the local area network and the services it provides.	0.57

toward system training. Accordingly, this factor was classified "system understanding and training." The factor loadings and items for this factor are listed in Table 16.

Importance to Top Management (Factor 6). The sixth factor was comprised of four items. The factor loading and items for this factor are listed in Table 17. Items comprising this factor all addressed the importance of the LAN to top management. Therefore, this factor was classified "importance to top management."

User/Management Relations (Factor 7). The factor analysis solution for this factor was comprised of three items. The factor loadings and items are listed in Table 18.

TABLE 17

FACTOR LOADINGS FOR IMPORTANCE TO TOP MANAGEMENT
(FACTOR 6)

Item Number	Item	Loading
48	This project is important to top management.	0.84
45	Top management sees the local area network as being important.	0.70
56	This system is important to my boss.	0.56
20	Top management provides the resources to implement the local area network.	0.37

These three items concentrate on the relations between the user and the LAN implementation/management team. Consequently, the classification "user/management relations" was used for this factor.

TABLE 18

FACTOR LOADINGS FOR USER/MANAGEMENT RELATIONS
(FACTOR 7)

Item Number	Item	Loading
52	When I talk to those managing the local area metwork, they respect my opinions.	0.75
51	I enjoy working with those who are managing the local area network.	0.71
38	The local area network does not require any changes in my organizational structure.	0.43

Reaction to Change (Factor 8). The final factor was comprised of three items. The factor loadings and items for this factor are listed in Table 19.

TABLE 19

FACTOR LOADINGS FOR REACTION TO CHANGE (FACTOR 8)

Item Number	Item	Loading
47	Top management does not realize how complex this change is.	0.80
46	Implementing the local area network was/is difficult.	0.74
44	People accept the required changes.	0.55

The items included in this factor all address user attitudes toward the complexity of changes produced by LAN implementation. An appropriate classification for this factor is "complexity of change."

While the interpretation of any factor analysis is subjective, the results obtained make a strong case in support of instrument validity. All 50 items emerged from the factor analysis with relatively high factor loadings. This resulted in a 100 percent retention rate of all items.

This analysis confirmed the emergence of a seven factor model to measure user attitudes, as did Schultz and Slevin's study. In this analysis, however, the final factor structure differed from the analysis conducted by Schultz

and Slevin in their study. A comparison of the differences in composition of the factors is shown below.

1. Job Performance: The final factor loading confirmed the Shultz and Slevin findings with the exception of the addition of items 41 and 49. Item 41 addresses increases to Air Force performance. The authors concluded that the respondents perceived this as a job performance measure. Item 49 addresses adequate staffing for successful implementation. The authors concluded that poor staffing would result in poor system performance. Therefore, respondents perceived this item as a measure of job performance.

2. Sense of Urgency: The final loading confirmed six of the seven items from the Shultz and Slevin instrument. The excluded item (56) loaded under the factor "Importance to Top Management." In reviewing the wording of this item (The system is important to my boss.), the authors concluded that this item was perceived, by respondents, as a measure of Importance to Top Management.

3. Interpersonal Relations: The final loadings confirmed the Shultz and Slevin findings with the addition of two items (39, 40). Reviewing the wording of item 39 (I have had to get to know several new people.), the authors concluded that respondents perceived this as a measure of Interpersonal Relations. The addition of item 40 is more difficult to explain. The authors propose that the physical location within the instrument and the wording of the item (Individuals set higher targets for performance.) combined to cause respondents to perceive this as a measure of Interpersonal Relations.

4. System Understanding and Training: This classification was not in the original Shultz and Slevin study. It consisted of three items (15, 17, 19) from the user satisfaction section and one item (50) from the attitude measures. After reviewing the wording of these items, the authors determined that each item addressed the construct of training or understanding. The authors propose that this new classification resulted from combining the user satisfaction instrument and a user attitude instrument.

5. Importance to Top Management: This classification, consisting of items 43, 45, 48, and 56 was also not in the Shultz and Slevin findings. After reviewing the wording of all items, the authors concluded that respondents perceived this classification as a measure of Importance to Top Management.

6. User/Management Relations: This classification, with the addition of item 38, confirmed Shultz and Slevin's findings. Upon reviewing the wording of item 38, the authors propose that the respondents perceived the "required changes in division" as a measure of User/Management Relations.

7. Complexity of Change: This classification, consisting of items 44, 46, and 47, was not included in the Shultz and Slevin findings. Upon reviewing the items wording, the authors concluded that this classification measured user attitudes toward the complexity of changes.

These differences in the factor classifications and the final factor structure between this study and the Schultz and Slevin study are accounted for by the inherent differences between the respective information systems studied and the composition of the instruments themselves. Schultz and Slevin endorsed the "tailoring" of their instrument for use in studying dissimilar information systems and advised the elimination of irrelevant items, provided rigorous factor analysis procedures are implemented (1975:156).

Conclusion. The authors have uniformly adhered to the required procedures for analyzing and certifying instrument validity. Based on the results of the factor analysis

performed on parts II and III, the instrument is considered valid.

Research Instrument Reliability. The responses to Parts II and III were analyzed to determine the overall reliability of the survey instrument used in this study by calculating Cronbach's coefficient alpha. In addition, using the results of the factor analysis, the responses to Parts II and III were analyzed individually to determine the reliability of the measures of user satisfaction and user attitudes using Cronbach's coefficient alpha.

The Cronbach Alpha reliability coefficient for the entire instrument was 0.95. The reliability coefficients for both Parts II and III were both 0.93. Finally, the reliability coefficients for each of the seven factors comprising Part III of the instrument are tabulated in Table 20 and range from 0.63 to 0.95. These values are acceptable and confirm the strength of the factors and the consistency of the items.

Findings and Analyses

This section reviews the results of the analysis of means, analysis of variance, correlational analysis, and regression analysis performed on the research data.

Analysis of Means. To answer research question three, which seeks to determine the overall effectiveness of the

TABLE 20

RELIABILITY COEFFICIENT FOR SURVEY INSTRUMENT
(SEE APPENDIX D FOR DETAILS)

Factor	Cronbach's Coefficient Alpha
Overall Instrument	.95
User Attitudes (Global)	.93
User Satisfaction (Factor 1)	.93
Job Performance (Factor 2)	.95
Sense of Urgency/LAN Importance (Factor 3)	.91
Interpersonal Relations (Factor 4)	.75
System Understanding and Training (Factor 5)	.86
Importance to Top Management (Factor 6)	.71
User/Management Relations (Factor 7)	.86
Complexity of Change (Factor 8)	.63

LAN, the mean score for all responses was calculated for the dependent variable user satisfaction.

An analysis of the PROC UNIVARIATE output for the seven-point Likert-scale revealed that the mean for the dependent variable was 4.62, with a standard deviation of

1.08. Therefore, with 95 percent certainty, the actual mean ranges from a low of 3.54 to a high of 5.70.

Using 4.0 as the midpoint of the seven-point Likert-scale, the response results indicate that the population of this study perceives the 4950th Test Wing LAN to be slightly effective.

Analysis of Variance. The sample population consists of all LAN users within the 4950th Test Wing. Within this larger framework, survey results were obtained from four separate and independent operating divisions within the wing. Statistical analysis using the one-way PROC ANOVA technique was conducted to determine if there was a significant difference in the mean scores for each division on the user satisfaction scale. The purpose of this procedure was to establish whether the entire sample was a valid representation of each sub-sample in terms of user satisfaction/system effectiveness or whether there were significant differences among the samples which required individual treatment and analyses.

The analysis of variance procedure is based on the assumption that there is no difference between the four divisions. The test statistic for this procedure is the F-statistic which measures the variance of the means. An F-statistic larger than 4.0 indicates there is a significant

difference between the means. Conversely, an F-statistic less than 4.0 indicates there is no significant difference between the means (Iversen and Norpoth, 1976:19).

First, an analysis was conducted to determine if there was any significant difference between the mean user satisfaction scores of the four divisions. The PROC ANOVA procedure performed on the data resulted in an F-statistic of 1.5 with an alpha of .21 (Appendix F).

Based on this finding, the authors concluded, with 95 percent certainty, that there was not a statistically significant difference between the four divisions in this study. Therefore, the four divisions can be treated as one large sample for purposes of further analysis.

Second, a review of the mean scores of user satisfaction indicated that the division with the largest percentage of top-level managers (4950 TW/SC) had the highest user satisfaction mean score among the four divisions. Analysis of variance was performed to determine if top management was significantly more satisfied with the LAN than the combination of the other three divisions. The calculated F-statistic using PROC ANOVA was 2.68 with an alpha of .10.

Based on this finding, the authors concluded, with 95 percent certainty, that there was not a significant

difference between the mean user satisfaction scores for the division with the most top managers and the other three divisions.

Third, a review of the mean scores of user satisfaction indicated that the divisions with the most proactive training programs (4950 TW/MA and 4950 TW/SC) had higher user satisfaction mean scores than the other two divisions. Analysis of variance was performed to determine if divisions with proactive training programs were significantly more satisfied with the LAN than the other two divisions. The calculated F-statistic using PROC ANOVA was 3.83 with an alpha of .06.

Based on this finding, the authors concluded, with 95 percent certainty, that there was not a significant difference between the mean user satisfaction scores for the two divisions with proactive training programs and the two with reactive training programs.

Finally, a review of the mean scores of user satisfaction indicated that the division which had a LAN E-Mail system (4950 TW/AM) had higher user satisfaction mean scores than the combination of the three divisions that had a VAX mainframe E-Mail system. Analysis of variance was performed to determine if the division with a LAN E-Mail system was significantly more satisfied with the LAN than

the group with a VAX mainframe E-Mail system. The calculated F-statistic using PROC ANOVA was .59 with an alpha of .44.

Based on this finding, the authors concluded, with 95 percent certainty, that there was not a significant difference between the mean user satisfaction scores for the divisions with a LAN E-Mail system and the group with a VAX mainframe E-Mail system.

Correlational Analysis. Correlational analysis was performed to evaluate the global relationship between user attitudes and user satisfaction (Appendix D). Then, correlational analysis was performed to evaluate the relationships between each of the seven attitude factors (Factors 2-8 as determined in the factor analysis) as independent variables and the user satisfaction factor (Factor 1) as the dependent variable (Appendix D). Finally, correlational analysis was performed to evaluate the relationship between user demographics and user satisfaction (Appendix D).

User Attitudes (Global) and User Satisfaction. The PROC CORR procedure performed on the data resulted in a Pearson Correlation Coefficient between user attitudes and user satisfaction of 0.58.

Analysis of this finding indicated that the correlation between global user attitudes and user satisfaction was significant at the .99 level of significance, suggesting a strong positive relationship exists. Therefore, an increase or decrease in the user attitudes (global) will result in an concomittant increase or decrease in user satisfaction.

Job Performance (Factor 2) and User Satisfaction. The PROC CORR performed on the data resulted in a Pearson Correlation Coefficient between job performance and user satisfaction of .63.

Analysis of this finding indicated that the correlation between job performance and user satisfaction was significant at the .99 level of significance, suggesting a strong positive relationship exists. Therefore, an increase or decrease in the contributions the LAN makes to job performance will result in an concomittant increase or decrease in user satisfaction.

Sense of Urgency/LAN Importance (Factor 3). The PROC CORR performed on the data resulted in a Pearson Correlation Coefficient between sense of urgency/LAN importance and user satisfaction of .54.

Analysis of this finding indicated that the correlation between sense of urgency/LAN importance and user satisfaction was significant at the .99 level of

significance, suggesting a strong positive relationship exists. Therefore, an increase or decrease in perceived importance of the LAN will result in an concomittant increase or decrease in user satisfaction.

Interpersonal Relations (Factor 4). The PROC CORR performed on the data resulted in a Pearson Correlation Coefficient between interpersonal relations and user satisfaction of -.21.

Analysis of this finding indicated that the correlation between interpersonal relations and user satisfaction was significant at the .99 level of significance. In contrast to previous findings, the negative correlation indicates that a strong negative relationship exists. Therefore, any change in interpersonal relations will decrease user satisfaction.

System Understanding and Training (Factor 5). The PROC CORR performed on the data resulted in a Pearson Correlation Coefficient between system understanding and training and user satisfaction of .63.

Analysis of this finding indicated that the correlation between system understanding and training and user satisfaction was significant at the .99 level of significance, suggesting a strong positive relationship exists. Therefore, an increase or decrease in system

training or understanding will result in an concomitant increase or decrease in user satisfaction.

Importance to Top Management (Factor 6). The PROC CORR performed on the data resulted in a Pearson Correlation Coefficient between importance to top management and user satisfaction of .41.

Analysis of this finding indicated that the correlation between importance to top management and user satisfaction was significant at the .99 level of significance, suggesting a strong positive relationship exists. Therefore, an increase or decrease in the importance of the LAN to top management will result in an concomitant increase or decrease in user satisfaction.

User/Manager Relations (Factor 7). The PROC CORR performed on the data resulted in a Pearson Correlation Coefficient between user/manager relations and user satisfaction of .41.

Analysis of this finding indicated that the correlation between user/manager relations and user satisfaction was significant at the .99 level of significance suggesting a strong positive relationship exists. Therefore, an increase or decrease in the quality of interaction between users and management will result in an concomitant increase or decrease in user satisfaction.

Complexity of Change (Factor 8). The PROC CORR performed on the data resulted in a Pearson Correlation Coefficient between complexity of change and user satisfaction of -.34.

Analysis of this finding indicated that the correlation between complexity of change and user satisfaction was significant at the .99 level of significance. This negative correlation indicates that a strong negative relationship exists. Therefore, any change precipitated by the LAN will decrease user satisfaction.

User Demographics and User Satisfaction. The PROC CORR was performed on the eight separate demographic variables (age, gender, education, supervisory, rank, computer experience, LAN experience, and new LAN experience) to determine the Pearson's Correlation Coefficients between demographics and user satisfaction. The results indicated that none of the demographic variables were correlated with user satisfaction.

Analysis of this finding indicated that there was no significant correlation between the individual demographic variables and user satisfaction at the .95 level of significance. The correlation coefficients for these relationships are tabulated in Appendix D. In contrast to the positive relationships found above, none of the

demographic variables were related to user satisfaction at the 0.95 level of significance.

Regression Analysis. Stepwise regression analysis procedures were used to determine which combination of attitude factors and demographic variables are statistically significant predictors of the effectiveness of the 4950th Test Wing LAN.

The significant results of the regression between user attitudes and user satisfaction appear in Table 21 and in Appendix G. A total of five of the seven attitude factors entered the regression equation as significant predictors of LAN effectiveness at the .95 significance level. These

TABLE 21

STEPWISE REGRESSION OF ATTITUDE FACTORS AS PREDICTORS OF USER SATISFACTION

Step	Independent Variable	R-Squared
1	System Understanding and Training (Factor 5)	.40
2	Job Performance (Factor 2)	.52
3	Complexity of Change (Factor 8)	.55
4	User/Management Relations (Factor 7)	.57
5	Interpersonal Relations (Factor 4)	.58

variables were "job performance", "interpersonal relations", "system understanding and training", "user/management relations", and "complexity of to change." The remaining two factors, "sense of urgency/LAN importance" amd importance to top management," were not significant predictors of the dependent variable at the .95 significance level.

The first factor to enter the equation was "system understanding and training." This factor explains 40 percent of the variance in the dependent variable and maintains a positive relationship with the dependent variable.

The inclusion of system understanding and training in this regression model indicates that this factor is a significant predictor of user satisfaction with the LAN. Based on these findings, a logical inference is that the more training a user receives and the better the user understands the system, the greater the probability that the user will be satisfied with the system. Conversely, a user who does not receive adequate training and has a relatively poor understanding of the system, is not likely to be as satisfied.

The second factor to enter the equation was "job performance." It explains an additional 12 percent of the

variation in user satisfaction and maintains a positive relationship with the dependent variable.

The inclusion of job performance in this regression model indicates that this factor is a significant predictor of user satisfaction with the LAN. System users' perceptions of the degree to which the LAN contributes to improving job performance directly affects their satisfaction with the system. For example, a user who perceives that the LAN has a significant impact on performance is inclined to be more satisfied with the system than a user who perceives the LAN does not significantly contribute to performance.

The third factor to enter the equation was "complexity of change." This factor explains 2.5 percent of the variance in the dependent variable and displays a negative a relationship with the dependent variable.

The inclusion of complexity of change in this regression model indicates that this factor is a significant predictor of user satisfaction with the LAN. In contrast to the previous two factors, this factor has a negative relationship with user satisfaction with the LAN. Any change precipitated by the LAN or any change to the LAN will decrease user satisfaction. The degree of decrease in satisfaction is a function of the degree of complexity of

the change. The more complex the change in the LAN, the less satisfied users are inclined to be.

The fourth factor to enter the model is "user/management relations." This factor explains 2.3 percent of the variance of the dependent variable user satisfaction and maintains a positive relationship with the dependent variable.

The inclusion of user/manager relations in this regression model indicates this factor is a significant predictor of user satisfaction. The quality of interaction between users and managers directly affects user satisfaction. This positive relationship indicates that system users who perceive that managers were responsive to their needs and opinions were more satisfied with the LAN.

The fifth factor to enter the equation is "interpersonal relations." It explains only 1.3 percent of the variance in the dependent variable while maintaining a negative correlation.

The inclusion of interpersonal relations as a factor in this regression model indicates it is a significant predictor of user satisfaction. A review of item wording disclosed that users perceived that changes in interpersonal relations were induced by the LAN. The negative correlation indicates this factor has an adverse effect on user

satisfaction. This supports the earlier finding that any change precipitated by the LAN will result in a decrease in user satisfaction.

In regression analysis performed on the demographic variables and user satisfaction, none of the eight variables analyzed entered the regression equation as predictors of LAN effectiveness at the .95 significance level. Therefore, none of these variables were significant predictors of effectiveness.

Conclusion. Of the seven attitude factors originally identified through factor analysis, five factors (Factor 5: System Understanding and Training, Factor 2: Job Performance, Factor 8: Complexity of Change, Factor 7: User/Management Relations, and Factor 4: Interpersonal Relations) were identified as being significant predictors of user satisfaction through regression analysis. However, of those five, the two factors which explained the most variance in the dependent variable, and combined to be the strongest predictors of user satisfaction were Factor 5: System Understanding and Training and Factor 2: Job Performance.

Local Area Network Effectiveness Model. In an effort to clearly and concisely represent the relational interactions between the factors in this study, a LAN system

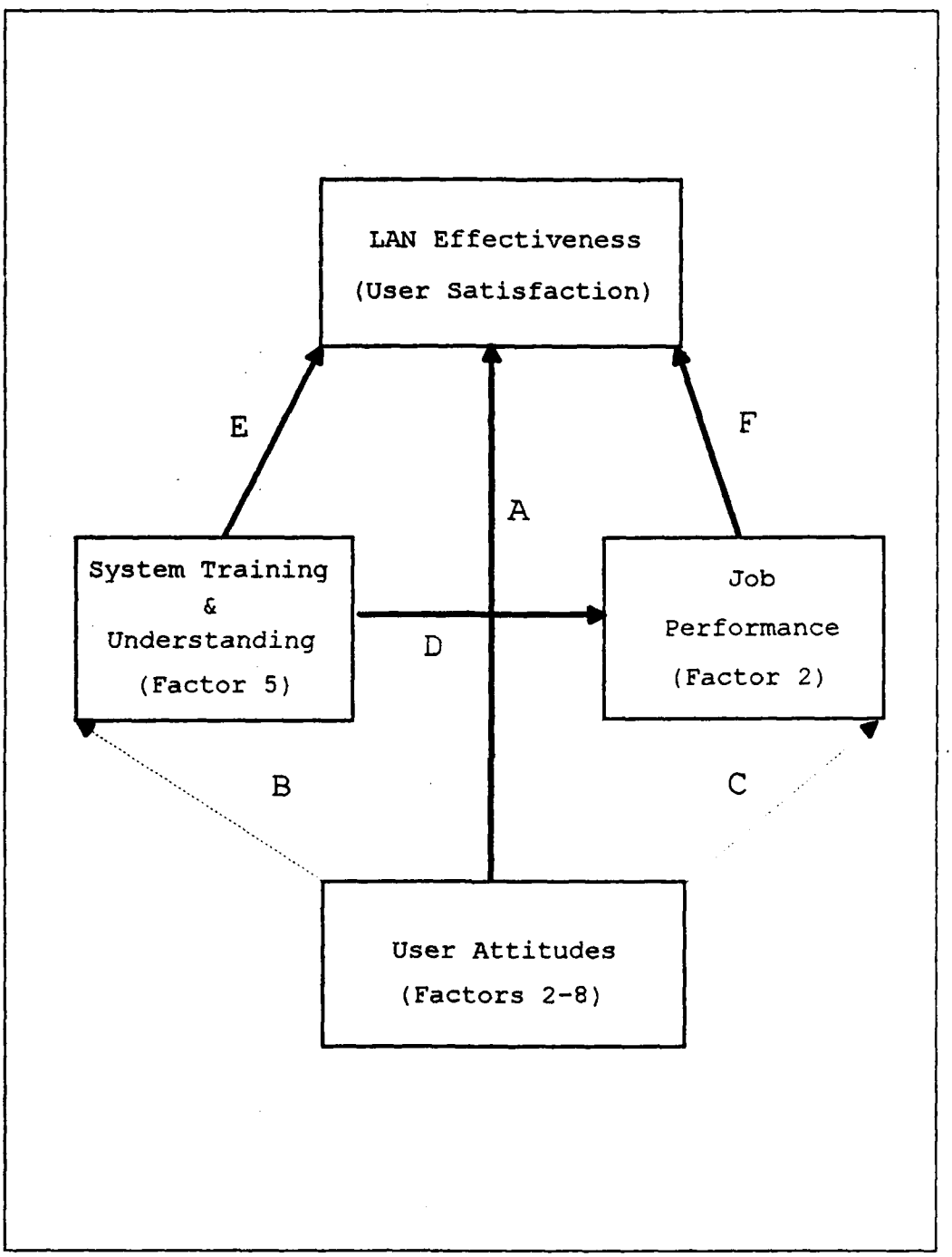

Figure 6. Local Area Network System Effectiveness Model

effectiveness model was developed (Figure 6). The model displays the correlational relationship (A) between the global job attitude construct and user satisfaction. At the factor level, the global job attitude construct is divided into its most statistically significant factors. For example, in this study, System Training and User Understanding, and Job Performance together are the strongest predictors of user satisfaction with the LAN (B&C). These two attitude factors are highly correlated with each other (D) as well as with the dependent variable user satisfaction (E&F).

Summary

The purpose of this chapter was: 1) to validate the research instrument; 2) to analyze the sample's mean user satisfaction; 3) to analyze correlational relationships between user attitudes and user satisfaction; 4) to analyze correlational relationships between demographics and user satisfaction; and 5) to construct a regression model to predict user satisfaction.

The next chapter will present conclusions and recommendations and suggestions for further research.

V. Conclusions and Recommendations

Introduction

LANs have proven a reliable means of accomplishing much of DOD's goal of ensuring "end-to-end information transfer capability which is protected, interoperable, and cost effective" (DMRD 918, 1992:1). From a global perspective, a countless number of LANs, within DOD, will need to be effectively and efficiently interconnected to provide this interoperability. Thus, the effectiveness of each individual LAN is key to the effectiveness of the entire system. Information systems (such as LANs) do not lend themselves to traditional quantitative measures of effectiveness as it is often impossible to calculate a dollar amount on data. Instead, researchers have developed qualitative measures of system effectiveness.

Much of the prior research supported using end-user satisfaction as a measure of system effectiveness. With this in mind, the objective of this research was to take a cross-sectional view of one LAN and determine what relationships, if any, exist between user satisfaction (system effectiveness) and demographics or user attitudes. It is hoped that factors which contribute to user satisfaction on one LAN can be used as a starting point to

evaluate other LANs and when enough data is collected, definitive conclusions can be made.

Chapter I, Introduction, identified that the primary objective of this research was: to determine the effectiveness of the 4950th Test Wing LAN, and the factors, if any, that contributed to that effectiveness. In order to achieve this objective, the authors developed five research questions. Chapter II, Literature Review, answered the first two of these research questions. Chapter IV, Findings and Analysis, presented the answers to the final three research questions. A brief summation of these questions is presented below:

Research Question 1. Does previous research validate the use of user satisfaction as a measurement of system effectiveness?

Based on an in-depth review of previous research, the authors are able to conclude that user satisfaction is a valid and widely accepted measurement of information systems effectiveness.

Research Question 2. Does previous research identify individual factors used to measure user satisfaction?

Based on an in-depth review of previous research, the authors identified two basic factors which have

traditionally been used to measure user satisfaction. These factors are user attitudes and demographics.

Research Question 3. How effective is the 4950th Test Wing LAN as measured by the degree of user satisfaction?

Based on the results of this research, it can be postulated that the 4950th Test Wing's LAN is slightly effective. Therefore, the decision to implement the LAN was well-advised and resulted in some degree of cost effectiveness.

Research Question 4. What is the relationship between user attitudes, user satisfaction, and the effectiveness of the 4950th Test Wing LAN?

The overall conclusion from this research confirmed that user attitudes affect user satisfaction.

Research Question 5. What is the relationship between demographic factors and user satisfaction, and the effectiveness of the 4950th Test Wing LAN.

The results of the statistical analysis in this study did not reveal any significant relationships between demographic factors and user satisfaction.

Conclusions and Recommendations

The regression model presented in Chapter IV clearly established a link between user attitudes and user satisfaction. Five of the seven attitude factors entered

the regression model as significant predictors of user satisfaction. In addition, the regression model indicated that demographics played no significant role in predicting user satisfaction. These attitude and demographic factors will be reviewed below in the form of conclusions.

Conclusion 1. Increased training leads to better system understanding, which in turn, leads to increased user satisfaction.

This research found that the degree of a user's understanding of the system is a significant predictor of the degree of that user's satisfaction. The regression model indicated that the attitude factor "System Understanding and Training" explained 40 percent of the variance in user satisfaction.

Recommendation 1. System managers should develop and maintain a proactive and dynamic training program. This training program should be designed to increase the user's overall understanding of the LAN and its associated applications.

Conclusion 2. The degree to which a user perceives that the LAN improves job performance may be used to predict the degree to which that user is satisfied.

The regression model indicated that the attitude factor "Job Performance" explained 12 percent of the variance in the dependent variable. The authors postulate that the value of the LAN, in terms of the user's perception of usefulness, is a significant predictor of user satisfaction.

Recommendation 2. System managers should carefully evaluate each existing and proposed LAN application from the users' perspective. In evaluating these applications, managers should solicit user inputs and integrate those system applications which result in improved job performance. Application selection criteria should be established. This application criteria should emphasize usefulness rather than the current trend which emphasizes the application's technical capabilities.

Conclusion 3. Any system changes are inclined to result in user dissatisfaction.

The regression model indicated that the attitude factor "Complexity of Change" explained 2.5 percent of the variance in the user satisfaction. In addition, this was a negative relationship which indicated that any changes would lead to dissatisfaction. The degree of dissatisfaction is a function of the degree of change complexity.

Recommendation 3. Managers should carefully consider the impact changes will have on user satisfaction. Then,

managers must weigh the costs, in terms of user satisfaction, against the benefits to be accrued from the changes.

Conclusion 4. System users who perceive that managers are responsive to their needs and opinions are more satisfied with the LAN.

The regression model indicated that the attitude factor "User/Management Relations" explained 2.3 percent of the variance in the user satisfaction. The authors postulate that the quality of interaction between users and managers directly affects user satisfaction. This relationship indicated that user satisfaction increased when managers considered users' opinions and needs.

Recommendation 4. Systems managers should create an atmosphere which encourages users to express their opinions and provide suggestions regarding LAN operations. Then, system managers should evaluate the content of the user inputs and incorporate those which will increase system effectiveness. This recommended approach should improve user/management relations, thus increasing user satisfaction.

Conclusion 5. Changes in interpersonal relationships, precipitated by the LAN, result in user dissatisfaction.

The regression model indicated that the attitude factor "Interpersonal Relations" explained 2.3 percent of the variance of user satisfaction. Surprisingly, these two factors were negatively correlated. In explaining this relationship, the authors submit that the users' need to make more interpersonal contact represents an increase in the interdependence between users. This interdependence amounts to a decrease in user independence which is negatively perceived by users. Therefore, this explains users' dissatisfaction with the LAN. In the case of the 4950th Test Wing LAN, the authors attribute the high level of user interdependence to relative system immaturity and users' inexperience.

Recommendation 5. Managers of the 4950th Test Wing LAN should use this study as a benchmark to perform future evaluations once the system matures and users' experience increases.

Conclusion 6. In this study, no relationship between demographics and user satisfaction exists.

When compared to previous studies, which revealed various relationships, the authors conclude that the relationship between demographics and user satisfaction is a unique function of each system.

Recommendation 6. Systems managers must evaluate their systems to determine if demographic factors are related significantly to user satisfaction.

Recommendations for Further Research

This research study sought to measure the operational effectiveness of the 4950th Test Wing LAN and explore the overall relationships between system effectiveness, user attitudes, and user demographics. The results of this study revealed a number of patterns in the relationships between these variables. Future research is required before these results can be generalized to a larger population.

Research Initiative 1. Conduct follow-on research studies, on various LAN implementations, to confirm the validity and reliability of the research instrument used in this study.

Research Initiative 2. Conduct a comparative study of a newly implemented LAN with a more mature LAN to determine the long-term effectiveness of these systems and the influencing factors.

Research Initiative 3. Conduct cross-sectional and longitudinal studies to further assess the effectiveness of LANs. In addition, studies are needed to identify more variables which might explain the success or failure of LANs and add to the body of knowledge in this important area.

Research Initiative 4. To expand on the scope of this study, conduct additional studies of similar LAN implementations to determine that their return on investment can be generalized to a broader cross-section of Air Force organizations.

Research Initiative 5. Conduct formal research to develop a two-dimensional model to measure information system effectiveness and determine system motivational factors which managers may use to improve effectiveness.

Summary

To achieve LAN system effectiveness, system managers must play an active role to promote and enhance user satisfaction. Some of the roles a system manager must perform are:

1) Proactive trainer. Designing a training program aimed at improving the user's overall system understanding.

2) Quality evaluator. Evaluating new and existing system applications software to ensure job applicability from a user's perspective.

3) Environment manager. Evaluating any changes to the system environment in an effort to balance the needs of the users with the needs of the system.

4) User/management liaison. Bridging the gap between users and managers by establishing and maintaining open lines of communication.

5) System process manager. Monitoring and evaluating the system to ensure it does not force any additional people into the decision process.

While the results of this study cannot be widely generalized, the implications of these findings are significant. In a large number of Air Force organizations, the cost-benefit approach is used as a guide in developing and implementing information systems. General practice advises against investment in any system unless the extra costs are exceeded by a measured improvement in performance and productivity.

This study is one of the first to apply effectiveness models to a LAN system. As such, it is a stepping stone for future studies and a model for LAN system effectiveness evaluations.

Appendix A: User Satisfaction Questionnaire

USER SATISFACTION QUESTIONNAIRE FOR THE 4950TH TEST WING **PC-BASED** LOCAL AREA NETWORK

GENERAL INFORMATION

The purpose of this questionnaire is to obtain background information about you and your degree of satisfaction with the 4950th Test Wing's **PC-based** local area network. This information is being collected in support of research assessing the effectiveness of the 4950th Test Wing's **PC-based** local area network.

This questionnaire is divided into three parts. The first part requests background information on you. The second part asks for your level of satisfaction with various aspects of the 4950th Test Wing **PC-based** local area network. The third part asks for your opinions regarding the 4950th Test Wing PC-based local area network.

495OTH TEST WING
PC-BASED LOCAL AREA NETWORK
QUESTIONNAIRE

INSTRUCTIONS

This questionnaire contains 59 items (individual questions). The questionnaire booklet is divided into three parts. Part I contains the first nine items in this booklet, Part II contains 15 items, and Part III contain 36 items. All items must be answered by filling in the appropriate spaces on the machine-scored response sheets provided. If for any item you do not find a response that fits your situation exactly, use the one that is the closest to the way you feel.

Please use a "soft-lead" (No.2) pencil, and observe the following:

1. Make heavy black marks that fill in the space (of the response you select).

2. Erase cleanly any responses you wish to change.

3. Make no stray marking of any kind on the response sheet.

4. Do not staple, fold or tear the response sheet.

5. Do not make any markings on the questionnaire booklet.

You have been provided with one answer sheet. Do NOT fill in your name on the sheet so that your response will be anonymous.

Each response block has 7 spaces (numbered 1 through 7) on a 1-7 scale. The questionnaire items normally require a response from 1-5 or 1-7. Questionnaire items are responded to by marking the appropriate space on the answer sheet as in the following example:

SCALE:

1 = Extremely dissatisfied
2 = Quite dissatisfied
3 = Slightly dissatisfied
4 = Neutral
5 = Slightly satisfied
6 = Quite satisfied
7 = Extremely satisfied

Sample Item 1:

The amount of job security I have.

(If you are "slightly satisfied" with sample item #1, you would "blacken in " the corresponding number of that statement (slightly satisfied = 5) on the answer sheet for item numbered "sample item 1.")

Sample response: 001 1 2 3 4 ● 6 7

PART I

BACKGROUND INFORMATION

This section of the survey contains several items dealing with personal characteristics and computer background..

1. Your age is:

    1. Less than 20
    2. 20 to 25
    3. 26 to 30
    4. 31 to 40
    5. 41 to 50
    6. 51 to 60
    7. More than 60

2. Your highest educational level attained was:

    1. High school graduate or GED
    2. Some college work
    3. Associate degree
    4. Undergraduate degree
    5. Graduate degree

3. Your sex is:

    1. Male
    2. Female

4. How many people do you directly supervise (i.e. those for which you write performance reports)?

    1. None
    2. 1 to 5
    3. 6 to 10
    3. 11 to 15
    4. 16 to 20
    5. 21 or more

5. You are a (an):

    1. Officer
    2. Enlisted
    3. Civilian (GS)
    4. Civilian (WG)
    5. Civilian (GM)
    5. Non-appropriated fund (NAF employee)
    6. Other

6. Your pay grade is (e.g., E-3, O-3, GS-5, etc.):

    1. 1-2
    2. 3-4
    3. 5-6
    4. 7-8
    5. 9-10
    6. 11-12
    7. 13-15

7. How much experience have you had with computers prior to using the 4950th Test Wing's PC-based local area network?

    1. Less than 3 months
    2. 3 to 6 months
    3. 6 to 12 months
    4. 1 to 2 years
    5. 3 to 5 years
    6. More than 5 years

8. How much experience have you had with local area networks prior to using the 4950th Test Wing's PC-based local area network?

    1. Less than 3 months
    2. 3 to 6 months
    3. 6 to 12 months
    4. 1 to 2 years
    5. 2 to 5 years
    6. More than 5 years

9. How much experience have you had with the 4950th Test Wing's PC-based local area network?

   1. Less than 1 month
   2. 1 to 2 months
   3. 3 to 4 months
   4. 5 to 6 months
   5. More than 6 months

PART II

4950TH TEST WING
PC-BASED LOCAL AREA NETWORK
USER SATISFACTION

Below are 14 items which relate to the degree to which you are satisfied with various aspects of the 4950th Test Wing's PC-based local area network. Read each item carefully and choose the statement below which best represents your opinion.

How satisfied are you with this aspect of the 4950th Test Wing's PC-based local area network?

1 = Extremely dissatisfied
2 = Quite dissatisfied
3 = Slightly dissatisfied
4 = Mixed (about equally satisfied and dissatisfied)
5 = Slightly satisfied
6 = Quite satisfied
7 = Extremely satisfied

Relevancy
10. The relevancy and usefulness of the products and services provided by the local area network.

Reliability
11. The reliability and dependability of the local area network.

Convenience of access
12. The ease of using the local area network.

Response/turnaround time
13. The time it takes the local area network to provide a service or complete an action.

Security of data
14. The safeguarding of data from misappropriation or unauthorized alteration or loss.

How satisfied are you with this aspect of the 4950th Test Wing's PC-based local area network?

1 = Extremely dissatisfied
2 = Quite dissatisfied
3 = Slightly dissatisfied
4 = Mixed (about equally satisfied and dissatisfied)
5 = Slightly satisfied
6 = Quite satisfied
7 = Extremely satisfied

Documentation
15. The formal instructions for using the local area network.

Expectations
16 The features and services provided by the local area network.

Understanding of the system
17. The degree to which I understand the local area network and the services it provides.

Perceived utility
18. The balance between the cost and the usefulness of the local area network.

Degree of training
19. The amount of specialized instruction and training provided.

Job effects
20. The changes in job freedom and job performance resulting from the local area network.

Flexibility of system
21. The capacity of the local area network to change or adjust in response to new conditions, demands, or circumstances.

Integration of system
22. The ability of the local area network to communicate/transmit data within the network.

Overall Satisfaction
23. The overall level of satisfaction with the local area network.

Part III

4950TH TEST WING
PC-BASED LOCAL AREA NETWORK
USER ATTITUDES/OPINIONS

Below are 36 items which relate to your feelings with respect to various aspects of the 4950th Test Wing PC-based local area network. Read each item carefully and choose the statement below which best represents your personal opinion.

Each statement implies **"since the PC-based local area network was implemented."** Therefore, response to each statement as it applies to the situation since the 4950th Test Wing PC-based local area network became operational. When responding to each statement, please keep this in mind.

1 = Strongly disagree
2 = Disagree
3 = Uncertain
4 = Agree
5 = Strongly agree

24. My job is more satisfying.

25. Others can better see the results of my efforts.

26. It is easier to perform my job well.

27. I have more control over my job.

28. I am able to improve my performance.

29. Others are more aware of what I am doing.

30. The local area network makes my job easier.

31. I am able to see better the results of my efforts.

32. The accuracy of my work is improved as a result of using the local area network.

33. The division/directorate/section performs better.

34. I need to communicate with others more.

Each statement implies **"since the PC-based local area network was implemented."** Therefore, response to each statement as it applies to the situation since the 4950th Test Wing PC-based local area network became operational. When responding to each statement, please keep this in mind.

1 = Strongly disagree
2 = Disagree
3 = Uncertain
4 = Agree
5 = Strongly Agree

35. I need the help of others more.

36. I need to consult others more often before making a decision.

37. I need to talk with other people more.

38. The local area network does not require any changes in division/directorate/section structure.

39. I have had to get to know several new people.

40. Individuals set higher targets for performance.

41. The use of this local area network increases the Air Force's performance.

42. This system (local area network) is technically sound.

43. Top management provides the resources to implement the local area network.

44. People accept the required changes.

45. Top management sees the local area network as being important.

46. Implementing the local area network was/is difficult.

47. Top management does not realize how complex this change is.

48. This project is important to top management.

49. There is adequate staff available to successfully implement/manage the local area network.

50. People are given sufficient training to utilize the local area network.

51. I enjoy working with those who are implementing/managing the local area network.

52. When I talk to those implementing/managing the local area network, they respect my opinions.

53. The local area network costs too much.

54. The local area network is important to me.

55. I need the local area network.

56. This system is important to my boss.

57. The local area network should have been put in earlier.

58. The sooner the local area network was in use the better.

59. Benefits outweigh the costs.

Appendix B: Raw Data File

The following file contains the raw data collected during the course of this research. The first eight numbers are the case numbers of each respondent. The actual data starts at column 10 and consist of 59 responses (which correlate to the 59 survey questions in Appendix ??) followed by 4 grouping digits. The grouping digits were added by researchers in order to group the individual groups into various LAN environments for statistical analysis. The data is recorded in this appendix in the original four groupings. Blanks within the data represent responses that were left blank on the individual case's response sheet.

Raw Data From 4950TW/AM

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Raw Data From 4950TW/FF

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Raw Data From 4950TW/MA

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Raw Data From 4950TW/SC

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Basic SAS Input File

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data thesisal;
infile thesisal missover;

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JobSat4 22 JobSat5 23 JobSat6 24 JobSat7 25 JobSat8 26
JobSat9 27 JobSat10 28 JobSat11 29 JobSat12 30 JobSat13 31 JobSat14 32
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Att10 42 Att11 43 Att12 44 Att13 45 Att14 46 Att15 47 Att16 48 Att17 49
Att18 50 Att19 51 Att20 52 Att21 53 Att22 54 Att23 55 Att24 56 Att25 57
Att26 58 Att27 59 Att28 60 Att29 61 Att30 62 Att31 63 Att32 64 Att33 65
Att34 66 Att35 67 Att36 68 eMail 69 Tng 70 topMgt 71 GrpID 72;
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        jobsat9+jobsat11+jobsat12+jobsat13+att19)/11;
factor2=(att1+att2+att3+att4+att5+att6+att7+att8+att9+att10+ATT18+att26
)/12;
factor4=(att12+att13+att14+att16+att17)/5;
factor5=(att27+jobsat6+jobsat8+jobsat10)/4;
factor6=(att20+att22+att25+att33)/4;
factor8=(att23+att24)/2;
factor7=(att28+att29)/2;
factor3=(att30+att31+att32+att34+att35+att36)/6;
factor9=factor8+factor2+factor3+factor4+factor5+factor6+factor7;
att12=6-att12;
att13=6-att13;
att14=6-att14;
att23=6-att23;
att24=6-att24;
att30=6-att30;
att16=6-att16;
att17=6-att17;
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Appendix C: Factor Analysis

Initial Factor Pattern

ITEM	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8
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11	0.64034	0.40080	-0.22722	0.12954	-0.19365	0.18763	0.04120	-0.05855
12	0.69557	0.30649	-0.11713	-0.00080	-0.16622	0.17036	-0.11328	0.13086
13	0.62245	0.33568	-0.17151	0.13713	-0.22691	0.13269	-0.00315	0.02614
14	0.60078	0.11525	-0.09148	0.17643	-0.21707	0.02288	-0.14419	-0.16220
15	0.59207	0.18587	-0.30884	-0.02563	0.00416	-0.45407	0.18681	0.18044
16	0.71464	0.27104	-0.27803	-0.00245	-0.23898	0.11510	0.09415	0.07104
17	0.64429	0.18395	0.02772	-0.25285	-0.03581	-0.42634	0.04269	0.06448
18	0.74997	0.17334	-0.01268	-0.05259	0.02096	0.24351	0.08801	0.06499
19	0.62098	0.14177	-0.31110	-0.04815	0.24305	-0.39873	0.13525	0.05828
20	0.78478	0.07173	0.02362	0.08407	0.10568	0.03813	0.08108	-0.01872
21	0.68614	0.31684	-0.22607	0.05880	-0.07897	-0.09682	-0.00270	-0.00991
22	0.70583	0.26928	-0.19009	0.16061	-0.29388	0.01355	-0.03509	-0.06944
23	0.82899	0.26287	-0.19492	0.12880	-0.23373	0.05129	-0.06417	0.02979
24	0.69829	-0.24551	0.36408	0.14794	-0.02918	-0.16621	-0.07796	0.04565
25	0.64459	-0.21653	0.34061	0.06674	-0.14030	-0.11263	0.08782	-0.00443
26	0.76846	-0.21229	0.30802	0.11193	-0.06130	0.01304	-0.02401	-0.00611
27	0.67733	-0.33403	0.34300	0.22717	-0.08556	-0.08012	0.05925	-0.00668
28	0.76622	-0.30030	0.26886	0.10302	-0.13117	-0.10774	-0.05668	-0.11168
29	0.59936	-0.23013	0.22394	-0.10399	-0.11601	-0.10951	0.12467	0.15133
30	0.75247	-0.13401	0.25903	0.09735	-0.09425	0.08792	-0.06766	-0.12638
31	0.77655	-0.27962	0.28611	0.11938	-0.05676	-0.01226	-0.00409	-0.09705
32	0.64023	-0.40823	0.20889	0.09266	0.09716	-0.16669	0.04324	0.01808
33	0.71502	-0.15692	0.11544	0.04247	-0.06831	-0.08837	0.11861	-0.11425
34	0.04355	-0.48771	-0.41383	0.14217	-0.28567	-0.02451	-0.14530	0.30315
35	0.27646	0.58309	0.37790	-0.20093	-0.00379	-0.24933	-0.00068	-0.03597
36	0.17672	0.60075	0.38713	-0.17142	0.09154	-0.08772	0.09687	-0.19341
37	0.26275	0.61026	0.41360	-0.20066	0.13878	-0.06569	0.18830	-0.11782
38	0.27341	-0.05702	0.20052	0.31780	0.15850	0.16113	-0.28674	-0.30653
39	-0.10162	0.54997	0.07735	-0.09494	0.08422	0.12245	0.16505	0.07542
40	-0.35513	0.48185	0.15638	-0.07959	0.29128	0.20228	-0.08937	-0.09931
41	0.72500	-0.18440	0.10669	-0.08499	0.00047	0.27832	-0.01743	-0.17388
42	0.62251	0.19677	-0.29704	0.24240	-0.04232	0.01143	0.01327	-0.11978
43	0.53116	-0.12252	-0.14455	0.33239	0.34795	0.09978	-0.03290	0.06630
44	0.43632	-0.12059	0.01229	0.21641	0.41103	-0.02096	-0.28679	0.30002
45	0.31246	-0.16167	-0.23333	0.30477	0.40619	0.20743	0.31953	-0.08503
46	0.33741	0.37119	0.25626	0.23325	0.15097	0.15493	-0.06222	0.52655
47	0.28596	0.24419	0.25956	0.29317	0.41045	0.27804	-0.03373	0.42552
48	0.28223	-0.20888	-0.38770	0.07274	0.28824	0.20148	0.53972	-0.30310
49	0.38279	0.08536	0.14587	0.33206	0.26738	-0.10383	0.08252	-0.28198
50	0.58506	-0.00597	-0.16066	-0.01915	0.31540	-0.45606	0.08798	0.17459
51	0.46206	0.13419	-0.41938	-0.15102	0.33559	-0.07475	-0.44874	-0.16418
52	0.45519	0.06322	-0.29809	0.00018	0.39525	-0.16804	-0.40966	-0.24475
53	0.51434	0.05551	0.20422	-0.33571	0.04852	0.33022	-0.01399	0.11860
54	0.71342	-0.23044	-0.07600	-0.42569	0.00747	0.13335	-0.16333	0.05331
55	0.64519	-0.28907	-0.04656	-0.45922	-0.00621	0.13562	-0.12371	-0.02386
56	0.42188	-0.36723	-0.13054	-0.17017	0.16347	0.17649	0.44504	0.13361
57	0.59069	-0.15503	-0.13252	-0.53289	0.06091	0.12004	0.02795	0.01025
58	0.65217	-0.18356	-0.03562	-0.47067	0.12496	0.09440	-0.02356	0.05791
59	0.71732	-0.10008	0.04755	-0.42270	0.16039	0.11602	-0.11431	-0.03585

Final Rotated Factor Pattern

ITEM	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8
10	**0.81683**	0.25578	0.16132	0.05814	0.08770	0.02561	-0.02091	0.05185
11	**0.80371**	0.09403	0.12502	0.13823	0.03976	0.12426	0.06494	0.07846
12	**0.70299**	0.16639	0.29670	0.08195	0.07872	-0.05722	0.06817	0.21759
13	**0.74616**	0.14866	0.11237	0.08000	0.06663	0.03518	0.03252	0.11629
14	**0.59151**	0.33238	0.06931	-0.00447	0.00876	-0.00940	0.20463	-0.03507
15	0.44770	0.14996	0.09761	0.02118	**0.71668**	0.08068	0.03558	0.02201
16	**0.77758**	0.13608	0.26984	0.02276	0.18583	0.09933	-0.03609	0.05977
17	0.33016	0.32470	0.28769	0.24516	**0.56710**	-0.13397	0.06201	-0.04457
18	**0.54908**	0.27907	0.40571	0.16429	0.06559	0.19180	0.02298	0.23357
19	0.34715	0.15266	0.17578	0.07637	**0.67671**	0.21756	0.23703	0.05056
20	**0.46371**	0.44202	0.26345	0.14006	0.18464	0.23571	0.14768	0.19313
21	**0.66796**	0.17473	0.14484	0.11913	0.30817	0.05958	0.16599	0.05929
22	**0.78715**	0.26685	0.08753	0.03743	0.12585	0.00975	0.09698	-0.00498
23	**0.82889**	0.30042	0.19927	0.02187	0.16975	0.01646	0.11729	0.11333
24	0.17315	**0.78783**	0.15950	0.00694	0.14777	-0.04778	0.09473	0.17243
25	0.20461	**0.72460**	0.18164	0.05062	0.11472	0.01163	-0.07192	0.04477
26	0.29242	**0.74941**	0.25988	0.02273	0.03754	0.05060	0.06117	0.15700
27	0.18571	**0.82468**	0.11170	-0.05729	0.06529	0.09153	-0.00547	0.11787
28	0.27469	**0.80957**	0.22840	-0.04150	0.08207	0.01520	0.11378	-0.00423
29	0.16142	**0.57002**	0.32471	-0.01775	0.22424	-0.00489	-0.15671	0.07385
30	0.36870	**0.67819**	0.26320	0.06796	-0.05884	0.05559	0.12327	0.07994
31	0.27087	**0.79112**	0.25284	-0.00199	0.03540	0.10488	0.09795	0.07159
32	0.04965	**0.71530**	0.22225	-0.11327	0.21883	0.15129	0.10188	0.10335
33	0.32798	**0.60667**	0.23226	0.03876	0.17228	0.16223	0.04824	-0.03472
34	0.10144	0.04039	0.02879	**-0.77099**	0.09408	-0.07313	-0.07088	-0.00707
35	0.20505	0.11863	0.04844	**0.68624**	0.22307	-0.28449	0.00299	0.05469
36	0.14858	0.04544	0.01968	**0.77213**	0.05589	-0.09963	0.01680	0.01391
37	0.16596	0.08030	0.08917	**0.81164**	0.11316	-0.03546	-0.04999	0.09183
38	0.10394	0.36106	-0.07118	0.07207	-0.30694	0.08589	0.42507	0.11304
39	0.12845	-0.32555	-0.03876	**0.45885**	-0.00474	0.00310	-0.14794	0.16235
40	-0.14689	-0.41943	-0.09235	**0.47675**	-0.23670	-0.03819	0.12876	0.15913
41	0.33942	**0.50863**	0.48094	0.03008	-0.13241	0.20819	0.13532	0.03039
42	**0.64895**	0.18757	0.02820	-0.00718	0.16424	0.22413	0.23180	0.03858
43	0.24381	0.29171	0.07725	-0.15062	0.11558	**0.37402**	0.33151	0.36770
44	0.05041	0.27167	0.13515	-0.14985	0.18909	0.05256	0.37218	**0.54721**
45	0.11592	0.12644	0.01672	-0.10327	0.04890	**0.69769**	0.14306	0.19605
46	0.27562	0.11165	-0.00063	0.21377	0.06706	-0.10608	-0.08482	**0.73657**
47	0.10665	0.11226	0.01573	0.20289	-0.03768	0.12696	0.04878	**0.79838**
48	0.13649	0.03490	0.14736	-0.08089	0.08090	**0.83855**	0.02758	-0.16482
49	0.15092	**0.38007**	-0.16810	0.25695	0.07149	0.30421	0.29693	0.08138
50	0.16029	0.27536	0.16636	0.02031	**0.69449**	0.15699	0.22322	0.16674
51	0.30626	-0.08724	0.34451	-0.02631	0.23613	0.02111	**0.70634**	0.02859
52	0.21396	0.07149	0.19364	0.00593	0.23897	0.08172	**0.74791**	0.02572
53	0.21498	0.21352	**0.59197**	0.21024	-0.08984	0.00666	-0.05996	0.22261
54	0.26840	0.32355	**0.75473**	-0.11103	0.12191	-0.00742	0.14987	0.01940
55	0.19035	0.33112	**0.75066**	-0.10425	0.07694	0.01796	0.12479	-0.07168
56	0.03359	0.22802	0.44994	-0.17025	0.18114	**0.50926**	-0.22556	0.07098
57	0.19978	0.16612	**0.75675**	-0.00535	0.18306	0.11006	0.04871	-0.07264
58	0.16576	0.27446	**0.74270**	0.00720	0.19475	0.08703	0.09539	0.03429
59	0.21560	0.33604	**0.71983**	0.11770	0.12442	0.05839	0.21286	0.05859

Appendix D: Correlational Analysis

Overall Instrument Reliability

Variable	No	Mean	Std Dev	Sum	Minimum	Maximum
JOBSAT1	147	5.07483	1.29323	746.00000	1.00000	7.00000
JOBSAT2	147	4.61905	1.63159	679.00000	1.00000	7.00000
JOBSAT3	147	4.93197	1.53792	725.00000	1.00000	7.00000
JOBSAT4	147	4.59184	1.54279	675.00000	1.00000	7.00000
JOBSAT5	147	5.16327	1.26621	759.00000	1.00000	7.00000
JOBSAT6	147	3.86395	1.68246	568.00000	1.00000	7.00000
JOBSAT7	147	4.89116	1.36557	719.00000	1.00000	7.00000
JOBSAT8	147	4.29252	1.59713	631.00000	1.00000	7.00000
JOBSAT9	147	4.42857	1.41905	651.00000	1.00000	7.00000
JOBSAT10	147	3.88435	1.85250	571.00000	1.00000	7.00000
JOBSAT11	147	4.51020	1.42563	663.00000	1.00000	7.00000
JOBSAT12	147	4.46259	1.45843	656.00000	1.00000	7.00000
JOBSAT13	147	4.90476	1.38650	721.00000	1.00000	7.00000
JOBSAT14	147	4.76190	1.44456	700.00000	1.00000	7.00000
ATT1	147	3.08844	0.99261	454.00000	1.00000	6.00000
ATT2	147	3.17007	0.98880	466.00000	1.00000	6.00000
ATT3	147	3.41497	1.04582	502.00000	1.00000	5.00000
ATT4	147	3.06803	1.05116	451.00000	1.00000	5.00000
ATT5	147	3.42857	1.01361	504.00000	1.00000	6.00000
ATT6	147	3.04762	0.98852	448.00000	1.00000	5.00000
ATT7	147	3.37415	1.08040	496.00000	1.00000	6.00000
ATT8	147	3.19728	1.03791	470.00000	1.00000	6.00000
ATT9	147	3.13605	1.06398	461.00000	1.00000	6.00000
ATT10	147	3.21769	0.93279	473.00000	1.00000	6.00000
ATT11	147	3.26531	1.00223	480.00000	1.00000	5.00000
ATT12	147	3.18367	1.14689	468.00000	0	5.00000
ATT13	147	3.63265	0.89199	534.00000	1.00000	5.00000
ATT14	147	3.28571	1.05337	483.00000	1.00000	5.00000
ATT15	147	3.11565	1.03047	458.00000	1.00000	6.00000
ATT16	147	3.15646	1.13295	464.00000	1.00000	5.00000
ATT17	147	3.07483	0.86078	452.00000	2.00000	5.00000
ATT18	147	3.46259	0.98809	509.00000	1.00000	6.00000
ATT19	147	3.35374	1.01227	493.00000	1.00000	6.00000
ATT20	147	3.42177	0.99261	503.00000	1.00000	6.00000
ATT21	147	3.21088	0.99472	472.00000	1.00000	5.00000
ATT22	147	3.53061	0.92386	519.00000	1.00000	6.00000
ATT23	147	2.74830	0.92042	404.00000	0	5.00000
ATT24	147	2.76190	0.93144	406.00000	0	5.00000
ATT25	147	3.54422	0.87766	521.00000	1.00000	6.00000
ATT26	147	2.98639	1.10408	439.00000	1.00000	5.00000
ATT27	147	2.63946	1.19900	388.00000	1.00000	5.00000
ATT28	147	3.78912	0.94529	557.00000	1.00000	5.00000
ATT29	147	3.53061	0.95305	519.00000	1.00000	5.00000

ATT30	147	3.01361	0.85196	443.00000	1.00000	5.00000
ATT31	147	3.52381	1.11240	518.00000	1.00000	6.00000
ATT32	147	3.44218	1.16530	506.00000	1.00000	7.00000
ATT33	147	3.46939	1.06826	510.00000	1.00000	5.00000
ATT34	147	3.64626	0.97083	536.00000	1.00000	5.00000
ATT35	147	3.65306	0.94834	537.00000	1.00000	5.00000
ATT36	147	3.27211	1.01737	481.00000	1.00000	5.00000

Cronbach Coefficient Alpha for RAW variables: 0.953087

Deleted Variable	Correlation With Total	Alpha
JOBSAT1	0.728011	0.951059
JOBSAT2	0.650098	0.951514
JOBSAT3	0.700903	0.951147
JOBSAT4	0.627262	0.951637
JOBSAT5	0.574329	0.951915
JOBSAT6	0.587805	0.951988
JOBSAT7	0.712916	0.951108
JOBSAT8	0.627049	0.951660
JOBSAT9	0.742143	0.950908
JOBSAT10	0.623532	0.951870
JOBSAT11	0.773309	0.950712
JOBSAT12	0.694922	0.951192
JOBSAT13	0.701543	0.951168
[illegible]SAT14	0.831063	0.950338
ATT1	0.635500	0.951735
ATT2	0.583236	0.951960
ATT3	0.712781	0.951345
ATT4	0.607146	0.951818
ATT5	0.699637	0.951438
ATT6	0.542464	0.952132
ATT7	0.705833	0.951342
ATT8	0.715853	0.951340
ATT9	0.570439	0.951978
ATT10	0.666321	0.951664
ATT11	-0.023544	0.954506
ATT12	0.303134	0.953251
ATT13	0.209925	0.953437
ATT14	0.292365	0.953224
ATT15	0.239151	0.953437
ATT16	-0.055675	0.954925
ATT17	-0.296757	0.955216
ATT18	0.673892	0.951576
ATT19	0.616163	0.951803
ATT20	0.507828	0.952277
ATT21	0.410053	0.952689
ATT22	0.294092	0.953136
ATT23	0.355338	0.952897
ATT24	0.296546	0.953131
ATT25	0.257758	0.953250
ATT26	0.371526	0.952897
ATT27	0.579652	0.951893
ATT28	0.459619	0.952486

ATT29	0.448976	0.952528
ATT30	0.485208	0.952417
ATT31	0.659387	0.951535
ATT32	0.580857	0.951895
ATT33	0.371188	0.952881
ATT34	0.548285	0.952116
ATT35	0.606124	0.951893
ATT36	0.677896	0.951529

User Attitude Reliability

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
ATT1	153	3.09150	1.00890	473.00000	1.00000	6.00000
ATT2	153	3.15686	1.00077	483.00000	1.00000	6.00000
ATT3	153	3.40523	1.06027	521.00000	1.00000	5.00000
ATT4	153	3.05229	1.06246	467.00000	1.00000	5.00000
ATT5	153	3.41830	1.02350	523.00000	1.00000	6.00000
ATT6	153	3.03268	0.99617	464.00000	1.00000	5.00000
ATT7	153	3.36601	1.10472	515.00000	1.00000	6.00000
ATT8	153	3.19608	1.07029	489.00000	1.00000	6.00000
ATT9	153	3.13072	1.08636	479.00000	1.00000	6.00000
ATT10	153	3.16993	0.96512	485.00000	1.00000	6.00000
ATT12	153	3.22222	1.14835	493.00000	0	5.00000
ATT13	153	3.63399	0.89407	556.00000	1.00000	5.00000
ATT14	153	3.30719	1.05307	506.00000	1.00000	5.00000
ATT15	153	3.13072	1.03041	479.00000	1.00000	6.00000
ATT16	153	3.20261	1.13763	490.00000	1.00000	5.00000
ATT17	153	3.10458	0.86727	475.00000	2.00000	5.00000
ATT18	153	3.41830	1.01705	523.00000	1.00000	6.00000
ATT19	153	3.33987	1.00107	511.00000	1.00000	6.00000
ATT20	153	3.38562	1.00082	518.00000	1.00000	6.00000
ATT21	153	3.20261	0.98247	490.00000	1.00000	5.00000
ATT22	153	3.48366	0.96043	533.00000	1.00000	6.00000
ATT23	153	2.75163	0.91249	421.00000	0	5.00000
ATT24	153	2.75163	0.92680	421.00000	0	5.00000
ATT25	153	3.50327	0.91136	536.00000	1.00000	6.00000
ATT26	153	2.96078	1.10550	453.00000	1.00000	5.00000
ATT27	153	2.59477	1.20546	397.00000	1.00000	5.00000
ATT28	153	3.78431	0.96615	579.00000	1.00000	5.00000
ATT29	153	3.54248	0.95963	542.00000	1.00000	5.00000
ATT30	153	3.00654	0.83899	460.00000	1.00000	5.00000
ATT31	153	3.52941	1.12425	540.00000	1.00000	6.00000
ATT32	153	3.43137	1.19078	525.00000	1.00000	7.00000
ATT33	153	3.43791	1.08719	526.00000	1.00000	5.00000
ATT34	153	3.63399	0.98510	556.00000	1.00000	5.00000
ATT35	153	3.64052	0.96392	557.00000	1.00000	5.00000
ATT36	153	3.26144	1.02451	499.00000	1.00000	5.00000
JOBSAT6	153	3.83007	1.68504	586.00000	1.00000	7.00000
JOBSAT8	153	4.28105	1.59133	655.00000	1.00000	7.00000

JOBSAT10 153 3.84967 1.84166 589.00000 1.00000 7.00000

Cronbach Coefficient Alpha for RAW variables: 0.926501

Deleted Variable	Correlation with Total	Alpha
ATT1	0.658465	0.922939
ATT2	0.609645	0.923432
ATT3	0.737244	0.922018
ATT4	0.633809	0.923087
ATT5	0.733851	0.922154
ATT6	0.576757	0.923757
ATT7	0.718938	0.922103
ATT8	0.749299	0.921865
ATT9	0.650036	0.922878
ATT10	0.676214	0.922869
ATT12	0.233179	0.927353
ATT13	0.196915	0.927146
ATT14	0.281876	0.926648
ATT15	0.222864	0.927181
ATT16	-0.124032	0.931052
ATT17	-0.308249	0.931117
ATT18	0.689238	0.922617
ATT19	0.528618	0.924215
ATT20	0.485294	0.924632
ATT21	0.436275	0.925101
ATT22	0.331883	0.926057
ATT23	0.310243	0.926208
ATT24	0.282109	0.926467
ATT25	0.256833	0.926666
ATT26	0.379745	0.925721
ATT27	0.621692	0.923042
ATT28	0.403611	0.925404
ATT29	0.424825	0.925209
ATT30	0.473232	0.924859
ATT31	0.670594	0.922591
ATT32	0.609060	0.923201
ATT33	0.428784	0.925196
ATT34	0.574408	0.923794
ATT35	0.645377	0.923162
ATT36	0.707692	0.922414
JOBSAT6	0.556244	0.924236
JOBSAT8	0.621243	0.923062
JOBSAT10	0.606187	0.923731

User Satisfaction
(Factor 1)

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
JOBSAT1	163	5.08589	1.32124	829.00000	1.00000	7.00000
JOBSAT2	163	4.63804	1.62474	756.00000	1.00000	7.00000
JOBSAT3	163	4.94479	1.52044	806.00000	1.00000	7.00000
JOBSAT4	163	4.63190	1.53139	755.00000	1.00000	7.00000
JOBSAT5	163	5.14724	1.28252	839.00000	1.00000	7.00000
JOBSAT7	163	4.87117	1.35240	794.00000	1.00000	7.00000
JOBSAT9	163	4.41104	1.41740	719.00000	1.00000	7.00000
JOBSAT11	163	4.47853	1.45864	730.00000	1.00000	7.00000
JOBSAT12	163	4.44172	1.45338	724.00000	1.00000	7.00000
JOBSAT13	163	4.87730	1.38231	795.00000	1.00000	7.00000
ATT19	163	3.35583	1.01641	547.00000	1.00000	6.00000

Cronbach Coefficient Alpha for RAW variables: 0.931983

Deleted Variable	Correlation with Total	Alpha
JOBSAT1	0.801871	0.922207
JOBSAT2	0.753254	0.924302
JOBSAT3	0.747326	0.924353
JOBSAT4	0.721667	0.925601
JOBSAT5	0.585013	0.931017
JOBSAT7	0.771397	0.923386
JOBSAT9	0.713347	0.925831
JOBSAT11	0.661326	0.928215
JOBSAT12	0.738890	0.924695
JOBSAT13	0.773457	0.923223
ATT19	0.652188	0.929075

User Attitude
(Factor 2)

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
ATT1	167	3.08982	1.03450	516.00000	1.00000	6.00000
ATT2	167	3.17964	0.99581	531.00000	1.00000	6.00000
ATT3	167	3.44311	1.07325	575.00000	1.00000	5.00000
ATT4	167	3.06587	1.07062	512.00000	1.00000	5.00000
ATT5	167	3.44910	1.03353	576.00000	1.00000	6.00000
ATT6	167	3.04790	0.99280	509.00000	1.00000	5.00000
ATT7	167	3.39521	1.10289	567.00000	1.00000	6.00000
ATT8	167	3.23353	1.06955	540.00000	1.00000	6.00000
ATT9	167	3.11377	1.06657	520.00000	1.00000	6.00000
ATT10	167	3.19760	0.97090	534.00000	1.00000	6.00000
ATT18	167	3.46707	1.01664	579.00000	1.00000	6.00000

Cronbach Coefficient Alpha for RAW variables: 0.947005

Deleted Variable	Correlation with Total	Alpha
ATT1	0.754958	0.942341
ATT2	0.736996	0.943013
ATT3	0.842528	0.938897
ATT4	0.787206	0.941100
ATT5	0.870667	0.937908
ATT6	0.659146	0.945810
ATT7	0.791799	0.940935
ATT8	0.864353	0.938031
ATT9	0.727547	0.943430
ATT10	0.689496	0.944706
ATT18	0.673265	0.945358

User Attitude
(Factor 3)

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
ATT30	164	3.00610	0.83993	493.00000	1.00000	5.00000
ATT31	164	3.51829	1.13220	577.00000	1.00000	6.00000
ATT32	164	3.42683	1.19847	562.00000	1.00000	7.00000
ATT34	164	3.62805	0.97927	595.00000	1.00000	5.00000
ATT35	164	3.64634	0.96404	598.00000	1.00000	5.00000
ATT36	164	3.26220	1.03238	535.00000	1.00000	5.00000

Cronbach Coefficient Alpha for RAW variables: 0.909137

Deleted Variable	Correlation with Total	Alpha
ATT30	0.506284	0.922497
ATT31	0.848954	0.877161
ATT32	0.796679	0.886706
ATT34	0.762128	0.891036
ATT35	0.789663	0.887438
ATT36	0.794986	0.885906

User Attitude
(Factor 4)

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
ATT11	170	3.23529	0.99878	550.00000	1.00000	5.00000

ATT12	170	3.22353	1.14485	548.00000	0	5.00000
ATT13	170	3.63529	0.88841	618.00000	1.00000	5.00000
ATT14	170	3.32353	1.05809	565.00000	1.00000	5.00000
ATT16	170	3.19412	1.13730	543.00000	1.00000	5.00000
ATT17	170	3.09412	0.89209	526.00000	1.00000	5.00000

Cronbach Coefficient Alpha for RAW variables: 0.442022

Deleted Variable	Correlation with Total	Alpha
ATT11	-0.598000	0.752965
ATT12	0.547804	0.151201
ATT13	0.587533	0.193496
ATT14	0.555219	0.167437
ATT16	0.312750	0.332720
ATT17	0.265477	0.373665

User Attitude
(Factor 5)

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
ATT27	172	2.65116	1.20202	456.00000	1.00000	5.00000
JOBSAT6	172	3.87791	1.66918	667.00000	1.00000	7.00000
JOBSAT8	172	4.30233	1.55650	740.00000	1.00000	7.00000
JOBSAT10	172	3.86047	1.82678	664.00000	1.00000	7.00000

Cronbach Coefficient Alpha for RAW variables: 0.861585

Deleted Variable	Correlation with Total	Alpha
ATT27	0.714491	0.834273
JOBSAT6	0.758616	0.802127
JOBSAT8	0.630534	0.854407
JOBSAT10	0.783145	0.794210

User Attitude
(Factor 6)

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
ATT20	170	3.39412	1.00471	577.00000	1.00000	6.00000

ATT22	170	3.45882	0.96756	588.00000	1.00000	6.00000
ATT25	170	3.48824	0.89864	593.00000	1.00000	6.00000
ATT33	170	3.41765	1.08062	581.00000	1.00000	5.00000

Cronbach Coefficient Alpha for RAW variables: 0.712507

Deleted Variable	Correlation with Total	Alpha
ATT20	0.417604	0.698977
ATT22	0.559437	0.613709
ATT25	0.548907	0.624589
ATT33	0.485558	0.661363

User Attitude
(Factor 7)

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
ATT28	169	3.82249	0.97796	646.00000	1.00000	7.00000
ATT29	169	3.57988	0.97947	605.00000	1.00000	7.00000
ATT15	169	3.19527	1.01933	540.00000	1.00000	6.00000

Cronbach Coefficient Alpha for RAW variables: 0.626707

Deleted Variable	Correlation with Total	Alpha
ATT28	0.582707	0.310615
ATT29	0.609701	0.267303
ATT15	0.180675	0.859993

User Attitude
(Factor 8)

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
ATT23	173	2.74566	0.96089	475.00000	1.00000	5.00000
ATT24	173	2.7[illegible]988	0.96236	474.00000	1.00000	5.00000
ATT21	173	3.19653	0.99217	553.00000	1.00000	5.00000

Cronbach Coefficient Alpha for RAW variables: 0.629100

Deleted Variable	Correlation with Tot[illegible]	Alpha
ATT23	0.444989	0.520764
ATT24	0.530186	0.397120
ATT21	0.347951	0.655559

Appendix E: Simple Statistics for Attitude Variables

Variable=ATT1

N	173	Sum Wgts	173
Mean	3.080925	Sum	533
Std Dev	1.047886	Variance	1.098064
Skewness	0.051406	Kurtosis	-0.53996
USS	1831	CSS	188.8671
CV	34.01205	Std Mean	0.079669
T:Mean=0	38.67143	Pr>|T|	0.0001
Num ^= 0	173	Num > 0	173
M(Sign)	86.5	Pr>=|M|	0.0001
Sgn Rank	7525.5	Pr>=|S|	0.0001

Variable=ATT2

N	173	Sum Wgts	173
Mean	3.16185	Sum	547
Std Dev	1.010032	Variance	1.020164
Skewness	0.011806	Kurtosis	-0.37493
USS	1905	CSS	175.4682
CV	31.94433	Std Mean	0.076791
T:Mean=0	41.17459	Pr>|T|	0.0001
Num ^= 0	173	Num > 0	173
M(Sign)	86.5	Pr>=|M|	0.0001
Sgn Rank	7525.5	Pr>=|S|	0.0001

Variable=ATT3

N	172	Sum Wgts	172
Mean	3.418605	Sum	588
Std Dev	1.081099	Variance	1.168775
Skewness	-0.44768	Kurtosis	-0.46988
USS	2210	CSS	199.8605
CV	31.62398	Std Mean	0.082433
T:Mean=0	41.47131	Pr>|T|	0.0001
Num ^= 0	172	Num > 0	172
M(Sign)	86	Pr>=|M|	0.0001
Sgn Rank	7439	Pr>=|S|	0.0001

Variable=ATT4

N	171	Sum Wgts	171
Mean	3.064327	Sum	524
Std Dev	1.063547	Variance	1.131132
Skewness	-0.04035	Kurtosis	-0.60412
USS	1798	CSS	192.2924
CV	34.70735	Std Mean	0.081331
T:Mean=0	37.67703	Pr>|T|	0.0001
Num ^= 0	171	Num > 0	171
M(Sign)	85.5	Pr>=|M|	0.0001
Sgn Rank	7353	Pr>=|S|	0.0001

Variable=ATT5

N	173	Sum Wgts	173
Mean	3.433526	Sum	594
Std Dev	1.041258	Variance	1.084218
Skewness	-0.35238	Kurtosis	-0.16519
USS	2226	CSS	186.4855
CV	30.3262	Std Mean	0.079165
T:Mean=0	43.37156	Pr>|T|	0.0001
Num ^= 0	173	Num > 0	173
M(Sign)	86.5	Pr>=|M|	0.0001
Sgn Rank	7525.5	Pr>=|S|	0.0001

Variable=ATT6

N	172	Sum Wgts	172
Mean	3.02907	Sum	521
Std Dev	0.987805	Variance	0.975758
Skewness	-0.13232	Kurtosis	-0.45367
USS	1745	CSS	166.8547
CV	32.61083	Std Mean	0.075319
T:Mean=0	40.21633	Pr>|T|	0.0001
Num ^= 0	172	Num > 0	172
M(Sign)	86	Pr>=|M|	0.0001
Sgn Rank	7439	Pr>=|S|	0.0001

Variable=ATT7

N	172	Sum Wgts	172
Mean	3.377907	Sum	581
Std Dev	1.109333	Variance	1.23062
Skewness	-0.42846	Kurtosis	-0.23534
USS	2173	CSS	210.436
CV	32.84085	Std Mean	0.084586
T:Mean=0	39.93465	Pr>|T|	0.0001
Num ^= 0	172	Num > 0	172
M(Sign)	86	Pr>=|M|	0.0001
Sgn. Rank	7439	Pr>=|S|	0.0001

Variable=ATT8

N	173	Sum Wgts	173
Mean	3.213873	Sum	556
Std Dev	1.070445	Variance	1.145853
Skewness	-0.12059	Kurtosis	-0.22825
USS	1984	CSS	197.0867
CV	33.30702	Std Mean	0.081384
T:Mean=0	39.49002	Pr>|T|	0.0001
Num ^= 0	173	Num > 0	173
M(Sign)	86.5	Pr>=|M|	0.0001
Sgn Rank	7525.5	Pr>=|S|	0.0001

Variable=ATT9

N	172	Sum Wgts	172
Mean	3.104651	Sum	534
Std Dev	1.059947	Variance	1.123487
Skewness	0.116698	Kurtosis	-0.33009
USS	1850	CSS	192.1163
CV	34.14061	Std Mean	0.08082
T:Mean=0	38.41431	Pr>|T|	0.0001
Num ^= 0	172	Num > 0	172
M(Sign)	86	Pr>=|M|	0.0001
Sgn Rank	7439	Pr>=|S|	0.0001

Variable=ATT10

N	173	Sum Wgts	173
Mean	3.196532	Sum	553
Std Dev	0.974435	Variance	0.949523
Skewness	-0.13734	Kurtosis	-0.05569
USS	1931	CSS	163.3179
CV	30.48412	Std Mean	0.074085
T:Mean=0	43.14688	Pr>|T|	0.0001
Num ^= 0	173	Num > 0	173
M(Sign)	86.5	Pr>=|M|	0.0001
Sgn Rank	7525.5	Pr>=|S|	0.0001

Variable=ATT11

N	173	Sum Wgts	173
Mean	3.231214	Sum	559
Std Dev	0.996364	Variance	0.992741
Skewness	-0.15805	Kurtosis	-0.60151
USS	1977	CSS	170.7514
CV	30.83559	Std Mean	0.075752
T:Mean=0	42.65508	Pr>|T|	0.0001
Num ^= 0	173	Num > 0	173
M(Sign)	86.5	Pr>=|M|	0.0001
Sgn Rank	7525.5	Pr>=|S|	0.0001

Variable=ATT12

N	173	Sum Wgts	173
Mean	2.780347	Sum	481
Std Dev	1.140311	Variance	1.300309
Skewness	0.488769	Kurtosis	-0.53528
USS	1561	CSS	223.6532
CV	41.01326	Std Mean	0.086696
T:Mean=0	32.06998	Pr>|T|	0.0001
Num ^= 0	173	Num > 0	173
M(Sign)	86.5	Pr>=|M|	0.0001
Sgn Rank	7525.5	Pr>=|S|	0.0001

Variable=ATT13

N	172	Sum Wgts	172
Mean	2.360465	Sum	406
Std Dev	0.884073	Variance	0.781586
Skewness	0.714264	Kurtosis	0.165309
USS	1092	CSS	133.6512
CV	37.45336	Std Mean	0.06741
T:Mean=0	35.01656	Pr>|T|	0.0001
Num ^= 0	172	Num > 0	172
M(Sign)	86	Pr>=|M|	0.0001
Sgn Rank	7439	Pr>=|S|	0.0001

Variable=ATT14

N	171	Sum Wgts	171
Mean	2.678363	Sum	458
Std Dev	1.055267	Variance	1.113588
Skewness	0.432329	Kurtosis	-0.66805
USS	1416	CSS	189.3099
CV	39.3997	Std Mean	0.080698
T:Mean=0	33.18984	Pr>|T|	0.0001
Num ^= 0	171	Num > 0	171
M(Sign)	85.5	Pr>=|M|	0.0001
Sgn Rank	7353	Pr>=|S|	0.0001

Variable=ATT15

N	172	Sum Wgts	172
Mean	3.197674	Sum	550
Std Dev	1.012435	Variance	1.025024
Skewness	-0.33794	Kurtosis	0.10286
USS	1934	CSS	175.2791
CV	31.66159	Std Mean	0.077197
T:Mean=0	41.42204	Pr>|T|	0.0001
Num ^= 0	172	Num > 0	172
M(Sign)	86	Pr>=|M|	0.0001
Sgn Rank	7439	Pr>=|S|	0.0001

Variable=ATT16

N	172	Sum Wgts	172
Mean	2.80814	Sum	483
Std Dev	1.135984	Variance	1.29046
Skewness	0.239051	Kurtosis	-1.01847
USS	1577	CSS	220.6686
CV	40.45326	Std Mean	0.086618
T:Mean=0	32.41983	Pr>|T|	0.0001
Num ^= 0	172	Num > 0	172
M(Sign)	86	Pr>=|M|	0.0001
Sgn Rank	7439	Pr>=|S|	0.0001

Variable=ATT17

N	172	Sum Wgts	172
Mean	2.895349	Sum	498
Std Dev	0.892189	Variance	0.796002
Skewness	-0.24218	Kurtosis	-0.67443
USS	1578	CSS	136.1163
CV	30.81457	Std Mean	0.068029
T:Mean=0	42.56064	Pr>|T|	0.0001
Num ^= 0	172	Num > 0	172
M(Sign)	86	Pr>=|M|	0.0001
Sgn Rank	7439	Pr>=|S|	0.0001

Variable=ATT18

N	173	Sum Wgts	173
Mean	3.445087	Sum	596
Std Dev	1.025059	Variance	1.050746
Skewness	-0.4564	Kurtosis	0.077914
USS	2234	CSS	180.7283
CV	29.75423	Std Mean	0.077934
T:Mean=0	44.2053	Pr>|T|	0.0001
Num ^= 0	173	Num > 0	173
M(Sign)	86.5	Pr>=|M|	0.0001
Sgn Rank	7525.5	Pr>=|S|	0.0001

Variable=ATT19

N	172	Sum Wgts	172
Mean	3.331395	Sum	573
Std Dev	1.014833	Variance	1.029886
Skewness	-0.19444	Kurtosis	-0.09305
USS	2085	CSS	176.1105
CV	30.4627	Std Mean	0.07738
T:Mean=0	43.05225	Pr>|T|	0.0001
Num ^= 0	172	Num > 0	172
M(Sign)	86	Pr>=|M|	0.0001
Sgn Rank	7439	Pr>=|S|	0.0001

Variable=ATT20

N	172	Sum Wgts	172
Mean	3.389535	Sum	583
Std Dev	0.999711	Variance	0.999422
Skewness	-0.34869	Kurtosis	0.058548
USS	2147	CSS	170.9012
CV	29.49405	Std Mean	0.076227
T:Mean=0	44.46619	Pr>|T|	0.0001
Num ^= 0	172	Num > 0	172
M(Sign)	86	Pr>=|M|	0.0001
Sgn Rank	7439	Pr>=|S|	0.0001

Variable=ATT21

N	173	Sum Wgts	173
Mean	3.196532	Sum	553
Std Dev	0.992173	Variance	0.984407
Skewness	-0.72955	Kurtosis	-0.19689
USS	1937	CSS	169.3179
CV	31.03903	Std Mean	0.075433
T:Mean=0	42.3755	Pr>|T|	0.0001
Num ^= 0	173	Num > 0	173
M(Sign)	86.5	Pr>=|M|	0.0001
Sgn Rank	7525.5	Pr>=|S|	0.0001

Variable=ATT22

N	173	Sum Wgts	173
Mean	3.450867	Sum	597
Std Dev	0.96096	Variance	0.923444
Skewness	-0.53486	Kurtosis	0.467408
USS	2219	CSS	158.8324
CV	27.84691	Std Mean	0.07306
T:Mean=0	47.23305	Pr>|T|	0.0001
Num ^= 0	173	Num > 0	173
M(Sign)	86.5	Pr>=|M|	0.0001
Sgn Rank	7525.5	Pr>=|S|	0.0001

Variable=ATT23

N	173	Sum Wgts	173
Mean	3.254335	Sum	563
Std Dev	0.96089	Variance	0.92331
Skewness	0.344627	Kurtosis	1.062377
USS	1991	CSS	158.8092
CV	29.52646	Std Mean	0.073055
T:Mean=0	44.5463	Pr>|T|	0.0001
Num ^= 0	173	Num > 0	173
M(Sign)	86.5	Pr>=|M|	0.0001
Sgn Rank	7525.5	Pr>=|S|	0.0001

Variable=ATT24

N	173	Sum Wgts	173
Mean	3.260116	Sum	564
Std Dev	0.962358	Variance	0.926133
Skewness	0.604846	Kurtosis	0.977143
USS	1998	CSS	159.2948
CV	29.51913	Std Mean	0.073167
T:Mean=0	44.55736	Pr>|T|	0.0001
Num ^= 0	173	Num > 0	173
M(Sign)	86.5	Pr>=|M|	0.0001
Sgn Rank	7525.5	Pr>=|S|	0.0001

Variable=ATT25

N	173	Sum Wgts	173
Mean	3.485549	Sum	603
Std Dev	0.893171	Variance	0.797755
Skewness	-0.32752	Kurtosis	1.06526
USS	2239	CSS	137.2139
CV	25.62498	Std Mean	0.067907
T:Mean=0	51.32861	Pr>|T|	0.0001
Num ^= 0	173	Num > 0	173
M(Sign)	86.5	Pr>=|M|	0.0001
Sgn Rank	7525.5	Pr>=|S|	0.0001

Variable=ATT26

N	172	Sum Wgts	172
Mean	2.97093	Sum	511
Std Dev	1.094523	Variance	1.19798
Skewness	-0.13145	Kurtosis	-0.63692
USS	1723	CSS	204.8547
CV	36.84108	Std Mean	0.083457
T:Mean=0	35.59851	Pr>|T|	0.0001
Num ^= 0	172	Num > 0	172
M(Sign)	86	Pr>=|M|	0.0001
Sgn Rank	7439	Pr>=|S|	0.0001

Variable=ATT27

N	173	Sum Wgts	173
Mean	2.647399	Sum	458
Std Dev	1.199543	Variance	1.438903
Skewness	0.219398	Kurtosis	-1.01613
USS	1460	CSS	247.4913
CV	45.31024	Std Mean	0.0912
T:Mean=0	29.02864	Pr>|T|	0.0001
Num ^= 0	173	Num > 0	173
M(Sign)	86.5	Pr>=|M|	0.0001
Sgn Rank	7525.5	Pr>=|S|	0.0001

Variable=ATT28

N	170	Sum Wgts	170
Mean	3.823529	Sum	650
Std Dev	0.975152	Variance	0.950922
Skewness	-0.68436	Kurtosis	1.346304
USS	2646	CSS	160.7059
CV	25.50399	Std Mean	0.074791
T:Mean=0	51.123	Pr>|T|	0.0001
Num ^= 0	170	Num > 0	170
M(Sign)	85	Pr>=|M|	0.0001
Sgn Rank	7267.5	Pr>=|S|	0.0001

Variable=ATT29

N	171	Sum Wgts	171
Mean	3.573099	Sum	611
Std Dev	0.975694	Variance	0.951978
Skewness	-0.32317	Kurtosis	1.036113
USS	2345	CSS	161.8363
CV	27.30665	Std Mean	0.074613
T:Mean=0	47.88833	Pr>|T|	0.0001
Num ^= 0	171	Num > 0	171
M(Sign)	85.5	Pr>=|M|	0.0001
Sgn Rank	7353	Pr>=|S|	0.0001

Variable=ATT30

N	171	Sum Wgts	171
Mean	3.017544	Sum	516
Std Dev	0.870927	Variance	0.758514
Skewness	-0.03413	Kurtosis	1.109028
USS	1686	CSS	128.9474
CV	28.86212	Std Mean	0.066601
T:Mean=0	45.30748	Pr>|T|	0.0001
Num ^= 0	171	Num > 0	171
M(Sign)	85.5	Pr>=|M|	0.0001
Sgn Rank	7353	Pr>=|S|	0.0001

Variable=ATT31

N	171	Sum Wgts	171
Mean	3.526316	Sum	603
Std Dev	1.134049	Variance	1.286068
Skewness	-0.62904	Kurtosis	-0.1873
USS	2345	CSS	218.6316
CV	32.15961	Std Mean	0.086723
T:Mean=0	40.66186	Pr>|T|	0.0001
Num ^= 0	171	Num > 0	171
M(Sign)	85.5	Pr>=|M|	0.0001
Sgn Rank	7353	Pr>=|S|	0.0001

Variable=ATT32

N	171	Sum Wgts	171
Mean	3.421053	Sum	585
Std Dev	1.192339	Variance	1.421672
Skewness	-0.35832	Kurtosis	-0.26359
USS	2243	CSS	241.6842
CV	34.85298	Std Mean	0.09118
T:Mean=0	37.51959	Pr>|T|	0.0001
Num ^= 0	171	Num > 0	171
M(Sign)	85.5	Pr>=|M|	0.0001
Sgn Rank	7353	Pr>=|S|	0.0001

Variable=ATT33

N	171	Sum Wgts	171
Mean	3.415205	Sum	584
Std Dev	1.077908	Variance	1.161885
Skewness	-0.31972	Kurtosis	-0.19484
USS	2192	CSS	197.5205
CV	31.56202	Std Mean	0.08243
T:Mean=0	41.43174	Pr>|T|	0.0001
Num ^= 0	171	Num > 0	171
M(Sign)	85.5	Pr>=|M|	0.0001
Sgn Rank	7353	Pr>=|S|	0.0001

Variable=ATT34

N	171	Sum Wgts	171
Mean	3.643275	Sum	623
Std Dev	0.973894	Variance	0.948469
Skewness	-0.54566	Kurtosis	0.416464
USS	2431	CSS	161.2398
CV	26.73128	Std Mean	0.074476
T:Mean=0	48.91909	Pr>|T|	0.0001
Num ^= 0	171	Num > 0	171
M(Sign)	85.5	Pr>=|M|	0.0001
Sgn Rank	7353	Pr>=|S|	0.0001

Variable=ATT35

N	170	Sum Wgts	170
Mean	3.635294	Sum	618
Std Dev	0.977221	Variance	0.95496
Skewness	-0.52084	Kurtosis	0.21185
USS	2408	CSS	161.3882
CV	26.88147	Std Mean	0.074949
T:Mean=0	48.50332	Pr>|T|	0.0001
Num ^= 0	170	Num > 0	170
M(Sign)	85	Pr>=|M|	0.0001
Sgn Rank	7267.5	Pr>=|S|	0.0001

Variable=ATT36

N	164	Sum Wgts	164
Mean	3.262195	Sum	535
Std Dev	1.032377	Variance	1.065801
Skewness	-0.27436	Kurtosis	0.146539
USS	1919	CSS	173.7256
CV	31.64668	Std Mean	0.080615
T:Mean=0	40.46632	Pr>|T|	0.0001
Num ^= 0	164	Num > 0	164
M(Sign)	82	Pr>=|M|	0.0001
Sgn Rank	6765	Pr>=|S|	0.0001

Variable=JOBSAT14

N	172	Sum Wgts	172
Mean	4.709302	Sum	810
Std Dev	1.449874	Variance	2.102135
Skewness	-0.56354	Kurtosis	-0.31076
USS	4174	CSS	359.4651
CV	30.78745	Std Mean	0.110552
T:Mean=0	42.59812	Pr>|T|	0.0001
Num ^= 0	172	Num > 0	172
M(Sign)	86	Pr>=|M|	0.0001
Sgn Rank	7439	Pr>=|S|	0.0001

Variable=JOBSAT

N	163	Sum Wgts	163
Mean	4.625767	Sum	754
Std Dev	1.083796	Variance	1.174614
Skewness	-0.29314	Kurtosis	-0.2118
USS	3678.116	CSS	190.2875
CV	23.42955	Std Mean	0.084889
T:Mean=0	54.49165	Pr>|T|	0.0001
Num ^= 0	163	Num > 0	163
M(Sign)	81.5	Pr>=|M|	0.0001
Sgn Rank	6683	Pr>=|S|	0.0001

Appendix F: ANOVA Results

This appendix presents the results of the statistical analysis of variance test. These test were conducted to examine the survey population and determine if any significant differences exist between various groups. As a result of this analysis, researchers were able to determine, with 95 percent confidence that there was no significant difference in job satisfaction between any of the separate groups. In essence, these ANOVA tests confirmed that the individual groups could be treated a single sample for statistical analysis.

Dependent Variable: JOBSAT

Class	Levels	Values
TOPMGT	2	1 2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	3.11504423	3.11504423	2.68	0.1036
Error	161	187.17243739	1.16256172		
Corrected Total	162	190.28748162			

R-Square	C.V.	Root MSE	JOBSAT Mean
0.016370	23.30903	1.0782216	4.6257669

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TOPMGT	1	3.11504423	3.11504423	2.68	0.1036

Bonferroni (Dunn) T tests for variable: JOBSAT
Alpha= 0.05 df= 161 MSE= 1.162562
Critical Value of T= 1.97
Minimum Significant Difference= 0.4486
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes= 45.05521
Means with the same letter are not significantly different.

Bon Grouping	Mean	N	TOPMGT
A	4.9360	27	1
A	4.5642	136	2

Dependent Variable: JOBSAT

Class	Levels	Values
EMAIL	2	1 2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.69631931	0.69631931	0.59	0.4430
Error	161	189.59116231	1.17758486		
Corrected Total	162	190.28748162			

R-Square	C.V.	Root MSE	JOBSAT Mean
0.003659	23.45916	1.0851658	4.6257669

Source	DF	Anova SS	Mean Square	F Value	Pr > F
EMAIL	1	0.69631931	0.69631931	0.59	0.4430

Bonferroni (Dunn) T tests for variable: JOBSAT
Alpha= 0.05 df= 161 MSE= 1.177585
Critical Value of T= 1.97
Minimum Significant Difference= 0.355
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes= 72.88344
Means with the same letter are not significantly different.

Bon Grouping	Mean	N	EMAIL
A	4.7174	55	1
A	4.5791	108	2

Dependent Variable: JOBSAT

Class	Levels	Values
TNG	2	1 2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	4.41601505	4.41601505	3.83	0.0522
Error	161	185.87146658	1.15448116		
Corrected Total	162	190.28748162			

R-Square	C.V.	Root MSE	JOBSAT Mean
0.023207	23.22789	1.0744678	4.6257669

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TNG	1	4.41601505	4.41601505	3.83	0.0522

Bonferroni (Dunn) T tests for variable: JOBSAT
Alpha= 0.05 df= 161 MSE= 1.154481
Critical Value of T= 1.97
Minimum Significant Difference= 0.3324
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes= 81.49693
Means with the same letter are not significantly different.

Bon Grouping	Mean	N	TNG
A	4.7894	82	1
A	4.4602	81	2

Dependent Variable: JOBSAT

Class	Levels	Values
GRPID	4	1 2 3 4

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	5.28204167	1.76068056	1.51	0.2132
Error	159	185.00543995	1.16355623		
Corrected Total	162	190.28748162			

R-Square	C.V.	Root MSE	JOBSAT Mean
0.027758	23.31900	1.0786826	4.6257669

Source	DF	Anova SS	Mean Square	F Value	Pr > F
GRPID	3	5.28204167	1.76068056	1.51	0.2132

Bonferroni (Dunn) T tests for variable: JOBSAT
Alpha= 0.05 Confidence= 0.95 df= 159 MSE= 1.163556
Critical Value of T= 2.67167
Comparisons significant at the 0.05 level are indicated by '***'.

GRPID Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit
4 - 1	-0.4585	0.2187	0.8959
4 - 3	-0.2359	0.4750	1.1859
4 - 2	-0.2447	0.4768	1.1983
1 - 4	-0.8959	-0.2187	0.4585
1 - 3	-0.3342	0.2563	0.8469
1 - 2	-0.3451	0.2581	0.8614
3 - 4	-1.1859	-0.4750	0.2359
3 - 1	-0.8469	-0.2563	0.3342
3 - 2	-0.6390	0.0018	0.6427
2 - 4	-1.1983	-0.4768	0.2447
2 - 1	-0.8614	-0.2581	0.3451
2 - 3	-0.6427	-0.0018	0.6390

Appendix G: Stepwise Procedure for Dependent Variable JOBSAT

Step 1 Variable FACTOR5 Entered
R-square = 0.39648578 C(p) = 64.70123447

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	1	68.57998069	68.57998069	95.26	0.0001
Error	145	104.38960384	0.71992830		
Total	146	172.96958453			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERCEP	2.75784292	0.20420204	131.31312323	182.40	0.0001
FACTOR5	0.51016396	0.05227039	68.57998069	95.26	0.0001

Step 2 Variable FACTOR2 Entered
R-square = 0.52419046 C(p) = 22.75128497

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	2	90.66900596	45.33450298	79.32	0.0001
Error	144	82.30057856	0.57153180		
Total	146	172.96958453			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERCEP	1.54726384	0.26649900	19.26539759	33.71	0.0001
FACTOR2	0.57368106	0.09227890	22.08902527	38.65	0.0001
FACTOR5	0.33731392	0.05424073	22.10333981	38.67	0.0001

Step 3 Variable FACTOR8 Entered
R-square = 0.54810102 C(p) = 16.52239383

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	3	94.80480558	31.60160186	57.81	0.0001
Error	143	78.16477895	0.54660685		
Total	146	172.96958453			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERCEP	2.45400446	0.42022305	18.64086310	34.10	0.0001
FACTOR2	0.52087812	0.09226336	17.42162725	31.87	0.0001
FACTOR5	0.32651682	0.05318984	20.59818200	37.68	0.0001
FACTOR8	-0.21489150	0.07812266	4.13579962	7.57	0.0067

Step 4 Variable FACTOR7 Entered
R-square = 0.57077255 C(p) = 10.71991812

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	4	98.72629093	24.68157273	47.21	0.0001
Error	142	74.24329360	0.52284010		
Total	146	172.96958453			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERCEP	1.95929073	0.44893205	9.95876364	19.05	0.0001
FACTOR2	0.50179557	0.09050386	16.07267945	30.74	0.0001
FACTOR5	0.27083222	0.05585.04	12.29350896	23.51	0.0001
FACTOR7	0.20897201	0.07630399	3.92148535	7.50	0.0070
FACTOR8	-0.21623513	0.07640696	4.18750741	8.01	0.0053

Step 5 Variable FACTOR4 Entered
R-square = 0.58357375 C(p) = 8.31434712

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	5	100.94050893	20.18810179	39.52	0.0001
Error	141	72.02907560	0.51084451		
Total	146	172.96958453			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERCEP	2.23397240	0.46295052	11.89529420	23.29	0.0001
FACTOR2	0.53840918	0.09117184	17.81526108	34.87	0.0001
FACTOR4	-0.18515184	0.08893285	2.21421800	4.33	0.0392
FACTOR5	0.25124011	0.05600490	10.28051037	20.12	0.0001
FACTOR7	0.21207451	0.07543831	4.03721424	7.90	0.0056
FACTOR8	-0.16255060	0.07980599	2.11931208	4.15	0.0435

Step 6 Variable FACTOR6 Entered
R-square = 0.59178232 C(p) = 7.48934277

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression		102.36034202	17.06005700	33.83	0.0001
Error	140	70.60924251	0.50435173		
Total	146	172.96958453			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERCEP	1.97715183	0.48479714	8.38867664	16.63	0.0001
FACTOR2	0.49508930	0.09419801	13.93211924	27.62	0.0001
FACTOR4	-0.22708886	0.09183277	3.08410965	6.11	0.0146
FACTOR5	0.23595702	0.05638841	8.83119820	17.51	0.0001
FACTOR6	0.16679856	0.09941237	1.41983309	2.82	0.0956
FACTOR7	0.19543817	0.07561032	3.36969142	6.68	0.0108
FACTOR8	-0.14857030	0.07973377	1.75110792	3.47	0.0645

All variables left in the model are significant at the .15 level.
No other variable met the .15 significance level for entry into the model.

Summary of Stepwise Procedure for Dependent Variable JOBSAT

Step	Variable Entered	Number In	Partial R**2	Model R**2	C(p)	F	Prob>F
1	FACTOR5	1	0.3965	0.3965	64.70	95.26	0.0001
2	FACTOR2	2	0.1277	0.5242	22.75	38.65	0.0001
3	FACTOR8	3	0.0239	0.5481	16.52	7.57	0.0067
4	FACTOR7	4	0.0227	0.5708	10.72	7.50	0.0070
5	FACTOR4	5	0.0128	0.5836	8.31	4.33	0.0392
6	FACTOR6	6	0.0082	0.5918	7.49	2.82	0.0956

Source	DF	Sum of Squares	Mean Square	F Value	
Source	6	102.36034	17.06006	33.826	0.0001
Error	140	70.60924	0.50435		
C Total	146	172.96958			

Root MSE	0.71018	R-square	0.5918
Dep Mean	4.63018	Adj R-sq	0.5743
C.V.	15.33801		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob>|T|
INTERCEP	1	1.977152	0.48479714	4.078	0.0001
FACTOR2	1	0.495089	0.09419801	5.256	0.0001
FACTOR4	1	-0.227089	0.09183277	-2.473	0.0146
FACTOR5	1	0.235957	0.05638841	4.184	0.0001
FACTOR6	1	0.166799	0.09941237	1.678	0.0956
FACTOR7	1	0.195438	0.07561032	2.585	0.0108
FACTOR8	1	-0.148570	0.07973377	-1.863	0.0645

Bibliography

Bailey, James and Sammy W. Pearson. "Development of a Tool for Measuring and Analyzing Computer User Satisfaction," Management Science, 29: 530-545 (1983).

Baroudi, Jack J. and Wanda J. Orlikowski. "A Short-Form Measure of User Information Satisfaction: A Psychometric Evaluation and Notes on Use," Journal of Management Information Systems, 4: 44-59 (Spring 1988).

Benjamin, Robert I. "Information Technology in the 1990s: A Long Range Planning Scenario" MIS Quarterly, 2:11-31 (June 1982).

Birks, James S. "Strategic Goal Considerations of Information Systems, Journal of Systems Management, 15: 42-52 (February 1971).

Cerullo, Michael J. "Information Systems Success Factors," Journal of Systems Management, 4: 10-19 (December 1980).

Cheney, Paul H. and George B. Dickson. "Organizational Characteristics and Information Systems: An Exploratory Investigation," Academy of Management Journal, 25: 170-184 (March 1982).

-----, Robert I. Mann and Donald L. Amoroso. "Organizational Factors Affecting the Success of End-User Computing," Journal of Information Systems, 3: 66-80 (Summer 1986).

Coale, Kristi and Laurie Flynn. "The PC Has Its Whole Future Ahead of It," InfoWorld, 13: 46 (August 12, 1991).

Couger, J. Daniel. "E Pluribus Computum," Harvard Business Review, 64: 87-91 (September/October 1986).

Cyert, Robert and Joseph A. March. A Behavioral Theory of the Firm, Englewood Cliff: Prentice-Hall, 1963.

Degroff, William. "The Information System Evaluation: An Emerging Management Responsibility," Government Finance, 10: 3-9 (September 1981).

Department of Defense. Defense Information Infrastructure. Defense Management Report Decision 918 . Washington: Government Printing Office, 15 September 1992.

Dickerson, Gary W. and others. "Key Information Systems Issues for the 1980s" MIS Quarterly, 4: 451-460 (June 1982)

Ein-Dor, P. and E. Segev. "Attitudes, Association, and Success of MIS," Computer Journal, 29: 212-216 (1986).

Emory, C. William and Donald R. Cooper. Business Research Methods, Boston: Richard D. Irwin Inc, 1991.

Fortier, Paul J. The Handbook of LAN Technology, Intertext Publications, McGraw-Hill Company New York, 1989.

Franz, C.R., D. Robey, and R.R. Koeblitz. "User Response to an Online Information System: A Field Experiment," MIS Quarterly, 10: 13-17 (1986).

Fuerst, W.L. and P.H. Cheney. "Factors Affecting the Percent of Utilization of Computer Based Decision Support Systems in the Oil Industry," Decision Sciences, 13: 554-569 (October 1982).

Ginzberg, Mark J. "Finding an Adequate Measure of OR/MS Effectiveness," Interfaces, 8: 57-63 (1978).

Goodhue, Dale L. "User Evaluations of MIS Success: What Are We Really Measuring," MIS Quarterly, 2: 303-314 (January 1992).

Green, Gary and Robert T. Heim. "After Implementation What's Next," Journal of Systems Management, 34: 10-15 (September 1983).

Hair J.F. Multivariate Analysis. Tulsa OK: Petroleum Publishing Company, 1979.

Hamilton, S. and N.L. Chervany. "Evaluating Information Systems Effectiveness," MIS Quarterly, 5: 79-86 (December 1981).

Harris, James. 4950th Test Wing/SC, System Administrator, Personal interview. June 1993.

Harrison, Allison W. and R. Kelly Rainer, Jr. "The Influence of Individual Differences on Skill in End-User Computing," Journal of Management Information Systems, 9: 93-111 (Summer 1992).

Hiltz, Starr Roxanne and Kenneth Johnson, "User Satisfaction with Computer-Mediated Communication Systems," Management Science, 36: 739-761 (June 1990).

Igbaria, Magid and Sidney A. Nachman. "Correlates of user satisfaction with end user computing," Information and Management, 19: 73-82 (1990).

Ives, Blake, Margrethe H. Olson, and Jack J. Baroudi, "The Measurement of User Information Satisfaction," Communications of the ACM, 26: 785-793 (October 1983).

Kim, Jae-On and Charles W. Mueller. Introduction to Factor Analysis. Beverly Hills: Sage Publications Inc, 1982.

King W.R. and J.I. Rodriquez. "Evaluating Management Information Systems," MIS Quarterly, 2: 264-278 (September 1978).

Lebleu, Ronald E. and Roger T. Sobowiak. "Power to the End-User" Information Strategy, The Executive's Journal, 3:17-20 (Winter 1991)

Levin, T. and C. Gordon. "Effect of Gender and Computer Experience on Attitudes Toward Computers," Journal of Educational Computing Research, 5: 69-88 (1989).

Lizardi, Carlos. 4950th Test Wing/FF, System Manager, Personal interview. June 1993.

Lucas, Henry C. "User Reactions and the Management of Information Services," Management Informatics, 3: 165-172 (1973).

-----. "Performance and Use of an Information System," Management Science, 15: 908-919 (April 1975).

-----. "Empirical Evidence for a Descriptive Model of Implementation," MIS Quarterly, 2: 27-52 (1978).

-----. Implementation: The Key to Successful Information Systems, Columbia University Press, 1981.

Martin, James and Kathleen Chapman, Local Area Networks Architecture and Implementation, Englewood Cliffs NJ: Prentice-Hall, 1989.

McClave, James T. and P. George Benson. Statistics for Business and Economics, New York: MacMillan Publishing Company, 1991.

McGovern, Patrick J. "Information technology: critical for corporate profitability," EDGE: Work Group Computing Report, 3: 3 (November 27, 1992).

McMullin, Paul E. A Longitudinal Study of the Relationship Between User Attitudes and the Success of the MAJCOM and AFRCE Work Information Management System. MS thesis, AFIT/GEM/LSM/85S-10. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1985 (AD-A161055).

Moran, Barbara. 4950th Test Wing/AMQ, System Administrator, Personal interview. June 1993.

Moschner, Kenneth W. and Frederick W. Nightengale. A Study of the Relationship Between User Attitudes and the Success of the MAJCOM and AFRCE Work Information Management System. MS thesis, AFIT/GEM/LSM/84S-15. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1984 (AD-A146956).

Muller, Nathan J. "Integrated Network Management," Information Systems Management, 4: 8-12 (Fall 1992).

Nelson, Brian. "Determinants of IS Success," MIS Quarterly, 14: 87-98 (1990).

Neumann, S. and E. Segev. "Evaluate Your Information System," Journal of Systems Management, 31: 52-60 (March 1980).

Nickell, G.S. and J.N. Pinto. "The Computer Attitude Scale," Computers in Human Behavior, 2: 301-306 (1986).

Nie, Norman H. and others. SPSS: Statistical Package for the Social Sciences. New York: McGraw-Hill Book Company, 1986.

Nolan, Randall and Henry Seward. "Measuring User Satisfaction to Evaluate Information Systems," Managing the Data Resource. Los Angeles: West Publishing Co, 1974.

Nunnally, Joseph C. Psychometric Methods. New York: McGraw-Hill, 1978.

Oppenheim, A. N. Questionnaire Design and Attitude Measurement. New York: Basic Books Inc, 1966.

Parsons, Robert. Statistical Analysis: A Decision-Making Approach, New York: Harper and Row Publishers, 1988.

Parten, Mildred B. Surveys, Polls, and Samples: Practical Procedures. New York: Cooper Square Publishers Inc, 1950.

Pentland, B.T. "Use and Productivity in Personal Computing: An Empirical Test," Preceedings of the Tenth International Conference on Information Systems, Cambridge MA, 400-410 (December 1989).

Powers, Richard F. and Gary W. Dickson. "MIS Project Management: Myths, Opinions, and Reality," California Management Review, 15: 147-156 (Spring 1973).

Raymond, Leonard. "Validating and Applying User Satisfaction As A Measure of MIS Success in Small Organizations," Information and Management, 12: 173-179 (1987).

Rivard, Suzanne and Sid L. Huff. "Factors of Success for End-User Computing," Communications of the ACM, 31: 552-561 (May 1988).

Robey, Daniel. "User Attitudes and Management Information System Use," Academy of Management Journal, 22: 527-538 (1979).

-----, and R.F. Zeller. "Factors Affecting the Success and Failure of an Information System for Product Quality," Interfaces, 8: 70-75 (1978).

-----, and M.M. Bakr. "Task Redesign: Individual Moderating and Novelty Effects," Human Relations, 38: 689-701 (1978).

Rodriquez, J.I. "The Design and Evaluation of a Strategic Issue Competitive Information System," Ph.D. Dissertation, University of Pittsburgh, (1977).

Schewe, C.D. "The Management Information System User: An Exploratory Behavioral Analysis," Academy of Management Journal, 19: 577-590 (December 1976).

Schlotzhauer, Sandra D. and Ramon C. Littell. SAS System for Elementary Statistical Analysis, Cary NC: SAS Institute Inc, 1987.

Schultz, Randall L. and Dennis P. Slevin. "Implementation and Organizational Validity: An Empirical Investigation," Implementing Operations Research/Management Science, New York: American Elsevier, 1974.

Shires, Dale. 4950th Test Wing/MA, NCOIC, Computer Resource Manager, Personal interview. June 1993.

Shore, John. "Computer Intimidation and Anxiety," Computers and People, 9-10:7-10; 26 (September-October 1987), and 11-12:12-16;27 (November-December 1987).

Srinivisan, Aranth. "Alternative Measures of System Effectiveness: Associations and Implications," MIS Quarterly, 4: 243-253 (September 1985).

Stamper, David A. Business Data Communications. Red Wood City CA: The Benjamin Cummings Publishing Company, 1991.

Stone, Edgar P. Research Methods in Organizational Behavior. Santa Monica: Goodyear Publishing Company, 1978.

Swanson, E. Burton. "Management Information Systems: Appreciation and Involvement," Management Science, 21: 173-188 (October 1974).

-----. "Measuring User Attitudes in MIS Research: A Review," Omega, 10: 157-165 (1982).

Tabachneck, Barbara G. and Linda S. Fidell. Using Multivariate Statistics. New York: Harper and Row, 1983.

Tafti, M.H. Alai. "A Three-Dimensional Model of User Satisfaction with Information Systems," Journal of Information Resource Management, 3: 4-10 (1992)

Tan, Boon W. and Tak Wah Lo. "Validation of a User Satisfaction Instrument for Office Automation Success," Information and Management, 18: 203-208 (1990).

Tanlamai, Uthai. "Users' Attitudes Toward the Implementation of Office Automation," Office Systems Research Journal, 9: 1-17 (Fall 1990).

Yaverbaum, Gayle J. "Critical Factors in the User Environment: An Experimental Study of Users, Organizations and Tasks," MIS Quarterly, 12: 75-88 (March 1988).

Zmud, Robert W. "Individual Differences and MIS Success: A Review of the Empirical Literature," Management Science, 25: 966-976 (October 1979).

Zurier, Steve. "LAN ho! When it comes to networks, no one tops the federal government," Government Computer News, 11: 4-6 (November 23, 1992).

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13. ABSTRACT *(Maximum 200 words)*

This research investigated the individual factors which directly impacted the effectiveness of the 4950th Test Wing local area network (LAN). Areas of interest included the relationships between demographic and user attitude factors and LAN effectiveness. A literature review provided the basis for: 1) operationally defining effectiveness as a subjective measure of user satisfaction; 2) identifying specific factors which impact information system effectiveness; and 3) developing a research instrument to measure user attitudes and user satisfaction. A questionnaire was administered to 342 LAN users; 173 were returned (a response rate of 51 percent). Sixteen factors (eight demographic factors and eight attitude factors) were treated as independent variables and user satisfaction was the dependent variable. Data analyses revealed that no demographic variables were significantly related to user satisfaction/LAN effectiveness. The global attitude factor (all seven attitude factors together) showed a positive relationship with the dependent variable. The two individual attitude factors, system understanding and training and job performance were the strongest predictors of user satisfaction/LAN effectiveness.

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